

**CHAPTER 2 –
SAFETY ANALYSIS REPORT FOR THE
CPP-666 FUEL STORAGE AREA (FSA)**

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2. FACILITY DESCRIPTION

2.1 Introduction

The facilities and operations of the FSA portion of the CPP-666 facility are described in this chapter. These descriptions provide the information necessary to support and understand the hazard and accident analyses presented in Chapter 3. The text and figures in this chapter are presented as an aid for the reader and are for descriptive purposes only.

In addition to the FSA, CPP-666, also known as the Fluorinel Dissolution Process and Fuel Storage (FAST) facility, houses the Fluorinel Dissolution Process Area (FDPA). This area was formerly used for the headend dissolution step in the reprocessing of nuclear fuel. The FDPA is inactive and is not addressed in this SAR. The FDPA does, however, have interfaces with the FSA that are identified and described in this chapter.

2.2 Requirements

The design criteria for CPP-666^{1,2} were based on the design codes, standards, regulations, and DOE orders existing at the time the design was initiated.^{3,4,5,6,7,8,9,10,11,12,13,14} Design requirements used in the evaluation of the FSA safety basis in this SAR are contained in the following DOE directives:

- U.S. Department of Energy (DOE) Order 420.1A, “Facility Safety”¹⁵
- DOE Idaho Operations Office (DOE-ID) AE, “DOE-ID Architectural Engineering Standards.”¹³

Additional design codes, standards, regulations, and DOE orders that were used in the design and evaluation of CPP-666 and the FSA are referred to where applicable in this chapter.

2.3 Facility Overview

The CPP-666 facility is located at the INTEC area of the INEEL. A cutaway view of the facility is shown in Figure 2-1.

The FSA began operations in April 1984, and has a specified design life of 40 years.² The original mission of the FSA was to provide short-term underwater storage of fuels destined to be reprocessed in the FDPA. When the decision to end fuel reprocessing was made in April 1992, the mission of the FSA changed to receiving and storing nuclear fuel for an undefined interim period. Fuel receipt and storage at the FSA is continuing until a decision is made regarding the ultimate disposition of the fuel or until alternative fuel storage options, such as dry storage, are selected and implemented. In accordance with a settlement agreement with the State of Idaho, DOE, and the U.S. Navy,¹⁶ all fuel must be removed from the FSA pools by December 31, 2023. The long-term effects of underwater storage of fuel at the FSA, particularly, the increased potential for corrosion damage, are considered in the hazard and accident analyses in Chapter 3.

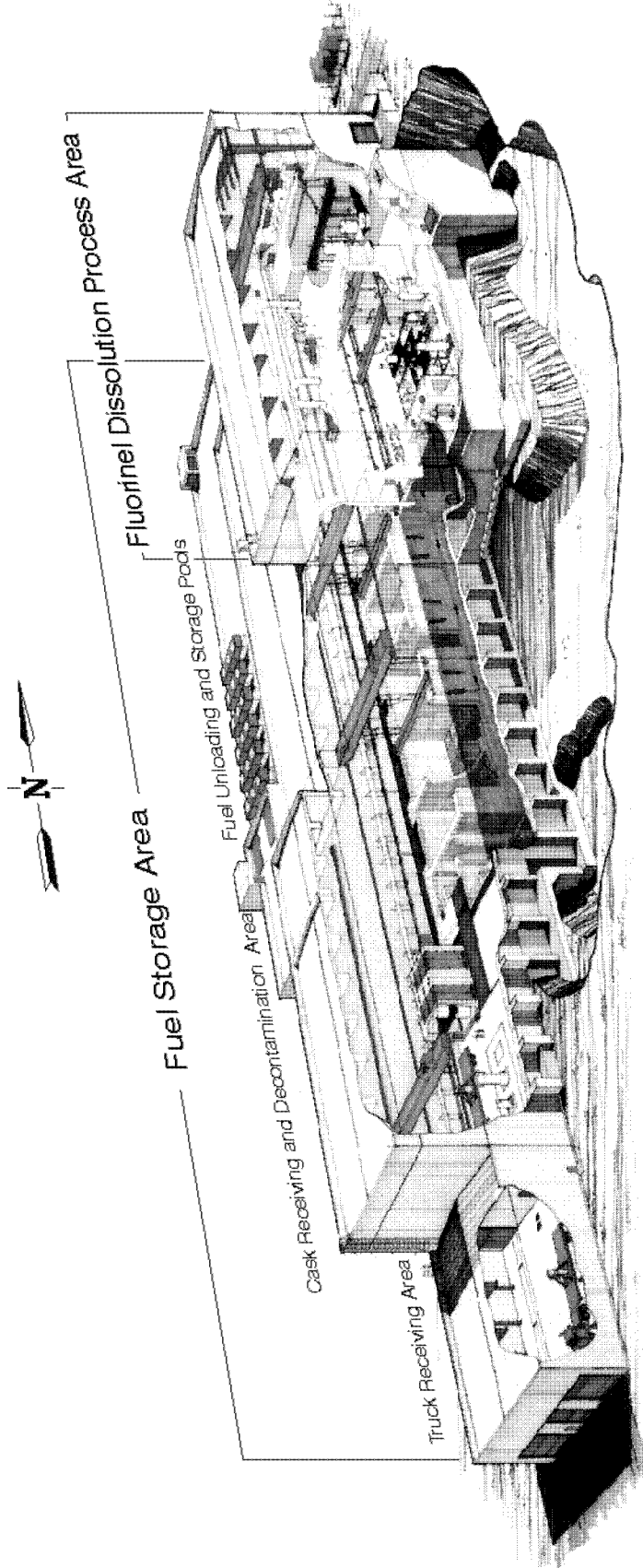
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Southeast View

Figure 2-1. Fluorinel Dissolution Process and Fuel Storage facility (cutaway view).

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FSA functions include receiving fuel-loaded casks,^a unloading fuel from these casks, preparing fuel for storage, transferring fuel to storage, storing fuel under water in fuel storage pools, retrieving fuel from storage and loading fuel into casks. The block diagram shown in Figure 2-2 illustrates the overall flow of FSA operations, including the materials entering and leaving the facility. A logic flow diagram is presented in Figure 2-3.

Only those fuels specified in an approved fuel listing may be received, handled, and stored at the FSA. The approved fuel listing is derived from a technical basis that is maintained in existing files and includes fuel data and analyses. In cases where fuel data are incomplete, conservative assumptions and analyses are used. The listing specifies approved fuel storage configurations, including fuel handling unit (FHU) definitions, storage equipment, fuel storage devices, rack type, and other requirements. Fuel storage devices, other than the racks themselves, include such items as overbatching prevention devices, space-filling devices, fuel stacking devices, cans, buckets, baskets, inserts, fixtures, etc.

FSA functional areas include the (1) truck receiving area; (2) cask receiving and decontamination area; (3) unloading area (including unloading and isolation pools); (4) storage pool area; (5) cutting pool area; (6) transfer channel; (7) water treatment area; (8) transfer channel extension; (9) main control room (now used as the shift operating base); (10) support areas, such as heating, ventilating, and air conditioning (HVAC); (11) office areas and other miscellaneous support areas consisting of storage rooms, restrooms, change rooms, and showers; and (12) transfer channel ramp to FDPA. Figure 2-4 shows the general layout of the areas within the FSA.

The primary FSA operations and/or operating systems include truck and cask receiving; fuel handling; fuel cutting and preparation; water treatment and management; heating, ventilating, and air conditioning; and waste management. Truck and cask receiving operations occur in the truck receiving and the cask receiving and decontamination areas. These receipt operations include receiving cask shipments, decontaminating and venting casks, and transporting casks to different locations within and between the cask receiving and decontamination area and the fuel unloading pools.

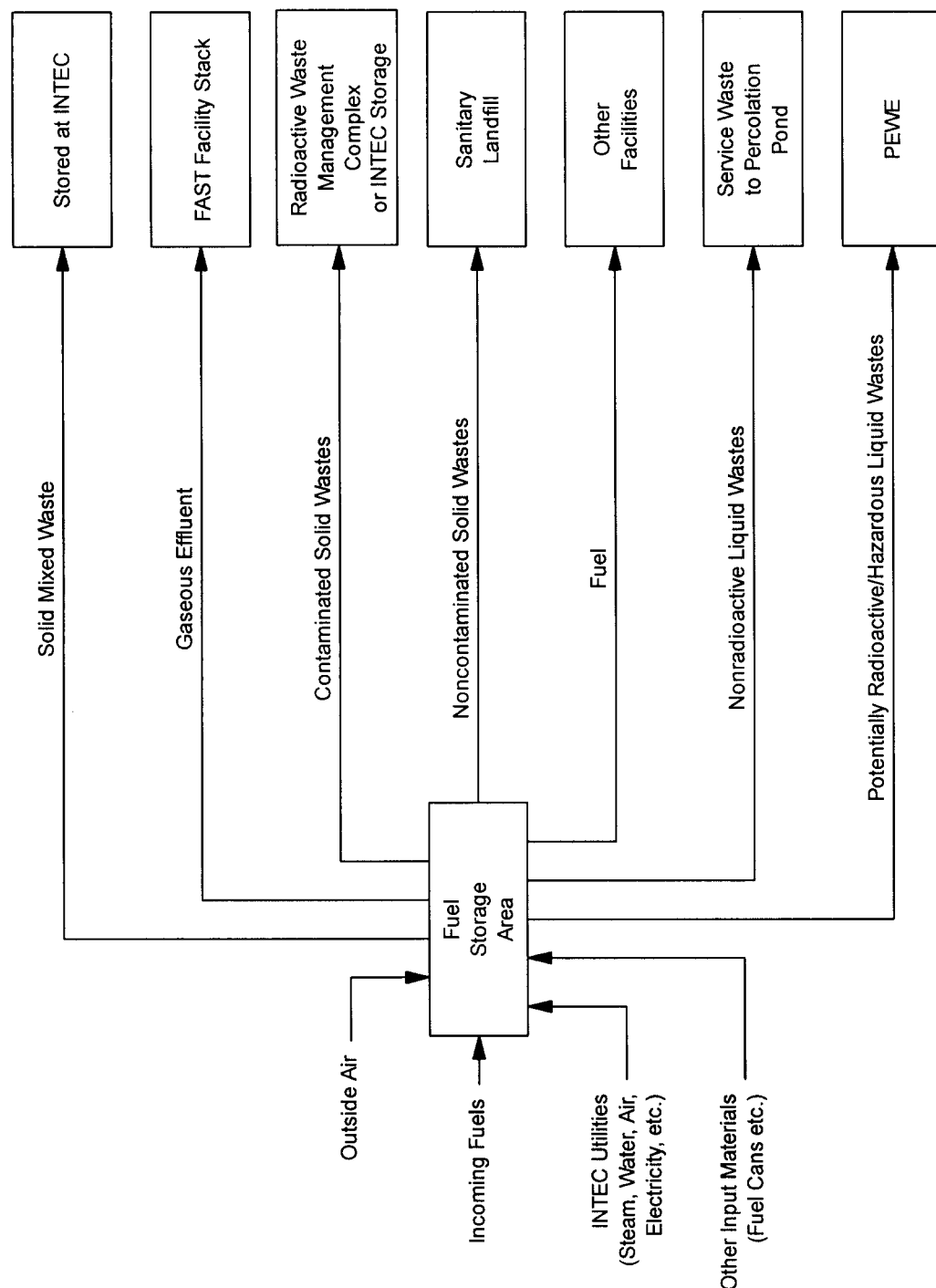
Fuel handling operations consist of cask loading and unloading as well as fuel inspection, repackaging, transfer, and storage. In addition, the facility is designed for testing and canning fuel, although these operations have not occurred in the past. The fuel handling operations take place in the unloading and isolation pools, the transfer channel, the transfer channel extension, and fuel storage pools.

Water treatment and management operations primarily occur in the water treatment support area. These operations consist of basin water makeup and distribution, basin water recirculation and management, basin liner leak detection, liquid waste collection, and some solid waste disposal activities. Some functions, including portions of the recirculation piping and leak detection, occur in the pool area.

The HVAC systems are primarily located in the HVAC support areas. These systems are operated to control the temperature and the possible spread of airborne contamination throughout the facility.

a. As used here, the term “cask” includes casks, chargers, and containers used to transport irradiated fuel.

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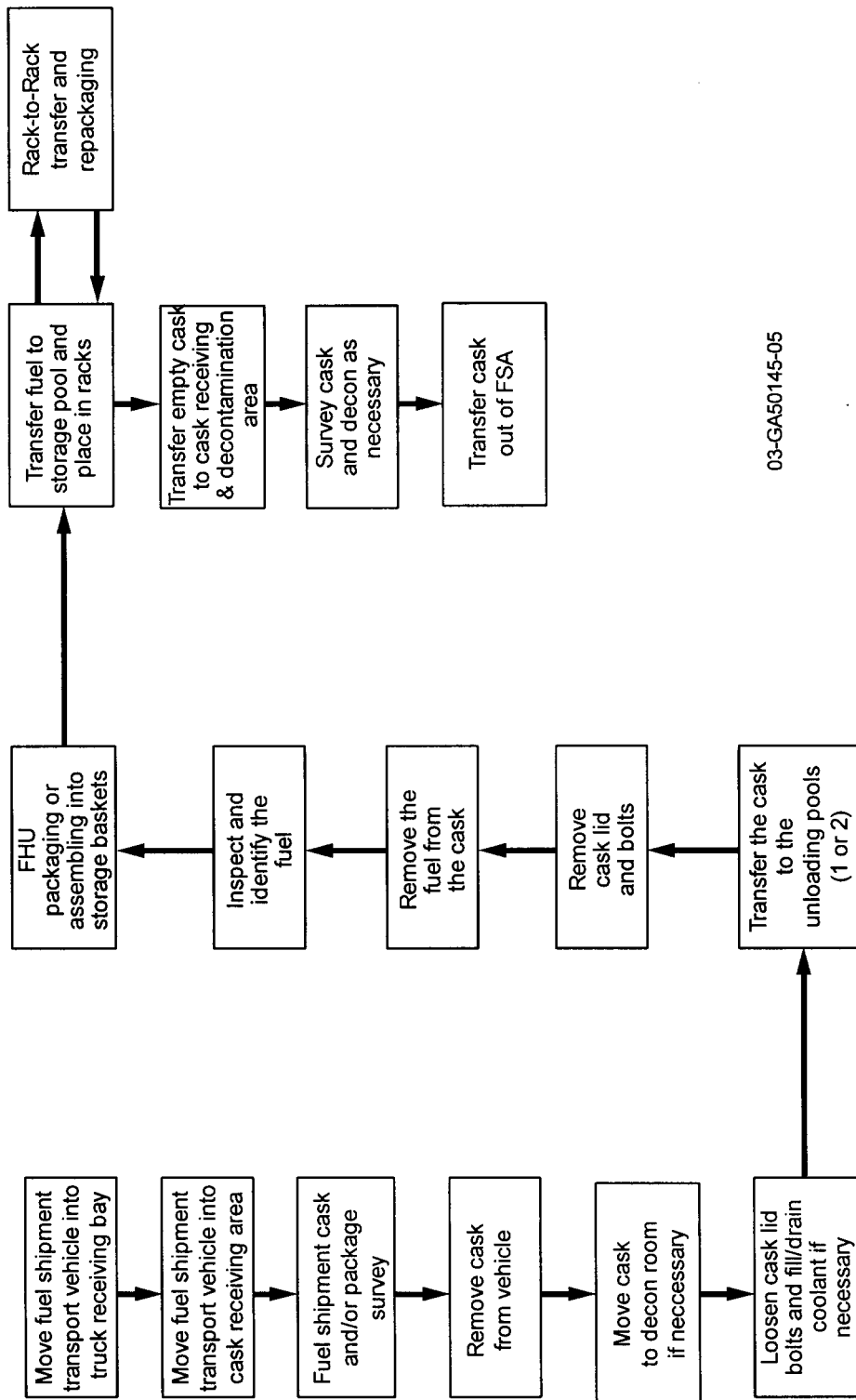
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Figure 2-2. Overall FSA block flow diagram.

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NOTE: This diagram is only a generalization of fuel handling in the FSA and is not intended as a precise description. The process of loading a cask with fuel would be performed in the reverse order from that described above.

Figure 2-3. Materials handling logic flow diagram.

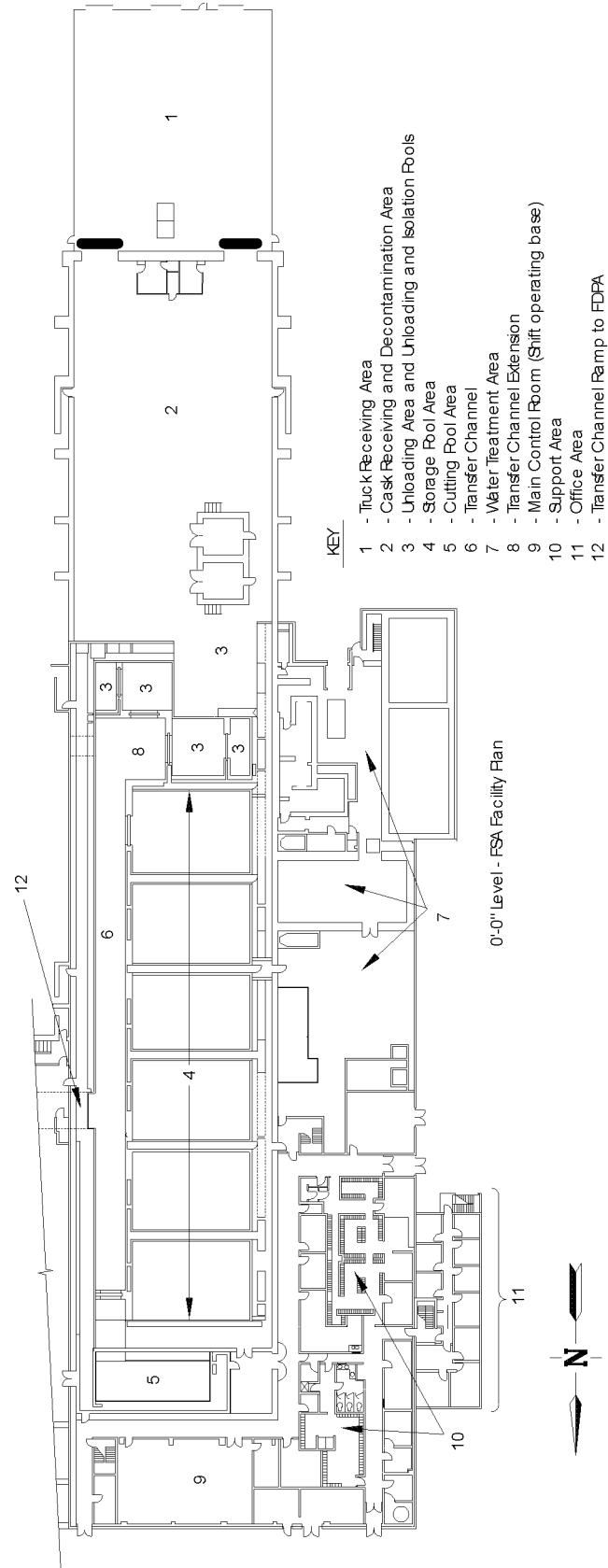
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Figure 2-4. FAST facility plan.

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The facility also contains equipment and systems to ensure proper disposal of wastes generated in the FSA. FSA operations generate gaseous, liquid, and solid waste materials that must be disposed of in an acceptable manner. Gaseous waste is collected and filtered in the CPP-666 HVAC system and released to the atmosphere via the 50-m-tall stack (CPP-767). Liquid effluents are processed in the INTEC liquid effluent systems. The solid wastes are transferred to the Radioactive Waste Management Complex (RWMC) or to a sanitary landfill.

Utilities, auxiliary systems, and special support functions including electrical power, water, steam, sewer, plant air, breathing air, nitrogen, communications and alarms, and fire protection are provided.

2.4 Facility Structure

CPP-666, which includes the FSA, the FDPA, and the associated support areas, consists of one building, occupying an area of approximately 120,000 ft². The building is constructed of reinforced concrete below grade and also above ground where radiation shielding or hardening for the design basis earthquake (DBE) or design basis tornado (DBT) is required. The remainder of the abovegrade structure is framed with structural steel, and the exterior walls are constructed of insulated metal siding.

Section 2.4.1 describes each major functional area of the FSA and the interfaces with the FDPA. Section 2.4.2 presents the structural design bases of the original design and reevaluations that have been performed to assess compliance with design codes, standards, regulations, and DOE orders issued after initial construction of the CPP-666 facility. A description of the casks authorized for handling and loading/unloading at the FSA is provided in Section 2.4.3.

2.4.1 FSA Description

The FSA with its supporting systems and facilities occupies approximately 79,100 ft² of the CPP-666 building. The FSA contains the following primary and support areas, as shown previously in Figure 2-4: (1) truck receiving area; (2) cask receiving and decontamination area; (3) unloading area (including unloading and isolation pools); (4) storage pool area; (5) cutting pool area; (6) transfer channel; (7) water treatment area; (8) transfer channel extension; (9) main control room (now used as the shift operating base); (10) support areas, such as HVAC; (11) office areas and other miscellaneous support areas, consisting of storage rooms, restrooms, change rooms, and showers; and (12) transfer channel ramp to FDPA. The following sections (2.4.1.1 through 2.4.1.11) describe each of these areas. Structural features or systems that interface with, or are shared by, the FDPA, including the transfer channel ramp, are discussed in Section 2.4.1.12.

2.4.1.1 Truck Receiving Area. Fuel shipments enter the FSA through the truck receiving area. Utility stations providing water and compressed air are located in the area so that the casks and transport vehicles can be cleansed of road dirt.

The truck receiving area is constructed of steel frames with insulated metal siding and an insulated roof deck. It is located on the south end of CPP-666 and is approximately 94 ft north and south and 76 ft east and west, resulting in a floor area of approximately 7,150 ft². A plan view of this area is shown in Figure 2-5. The truck receiving area is sized to accommodate two 10-ft-wide by 77-ft-long truck/trailer combinations, side by side. The area is entered through one of three insulated metal roll-up doors on the south side of the area. The east and west doors are used for receipt of fuel shipments (such as casks) and are each 16 ft wide and 19 ft high. The center door is used occasionally for freight receipt at the facility, and is 12 ft wide and 19 ft high. There are also three outer personnel access entries. Inside, the truck

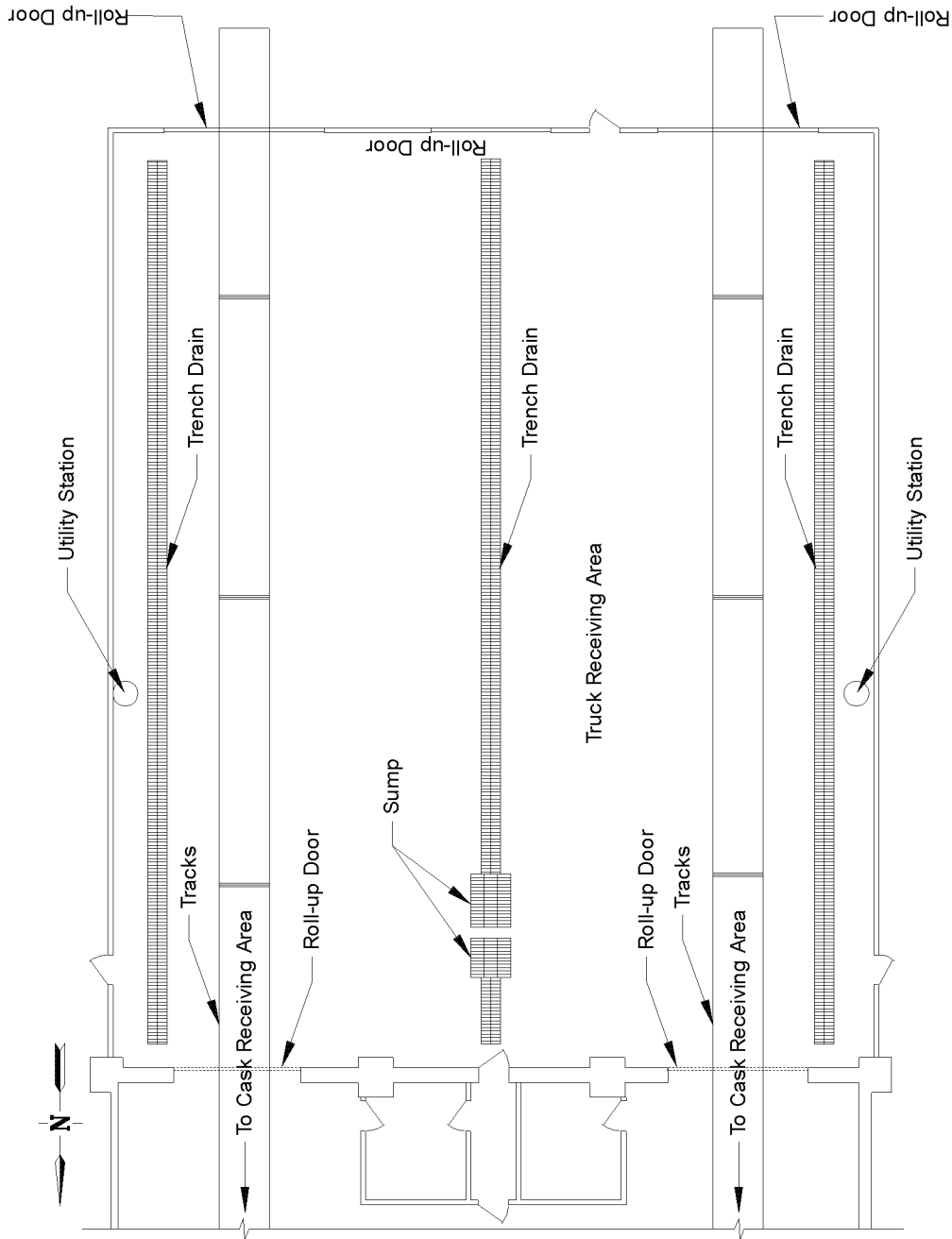
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Note: The original design provided for cask shipments by rail, but the rail spur was never extended to the FAST Facility.

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Figure 2-5. Truck receiving area.

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receiving area is divided into two receiving bays. Two insulated metal roll-up doors on the north end of the area, each 19 ft high and 14 ft wide, allow vehicle access into the cask receiving and decontamination area. An additional personnel access door, located near the center of the north interior wall of the area, also allows personnel entrance into the same area.

2.4.1.2 Cask Receiving and Decontamination Area. In the cask receiving and decontamination area, incoming and outgoing casks are surveyed for contamination, prepared for unloading, decontaminated, and prepared for return shipment. This is a personnel-occupied area where direct-contact operations are performed. It is located between the fuel unloading area and the truck receiving area. Overall dimensions are approximately 76 ft east and west and 138 ft north and south, resulting in a total area of approximately 10,500 ft². The structure is constructed of reinforced concrete, with a roof system of prestressed concrete beams and roof planks covered with concrete roof pad.

The cask receiving and decontamination area, illustrated in Figure 2-6, is large enough to accommodate two 10-ft-wide by 77-ft-long truck/trailer combinations, side by side. A storage area, measuring approximately 45 ft by 20 ft is provided for temporary storage of casks or equipment; and two decontamination (decon) rooms are located in the area. The maximum height of a cask shipment is physically limited to less than 19 ft (nominal), which is the height of the roll-up doors.

The cask receiving and decontamination area contains a staging area for preparing casks for transfer to, or from, the fuel unloading area. A 130-ton overhead crane with a 25-ton auxiliary hoist (CRN-FR-903) is provided for cask handling operations. The staging area is equipped with lifting devices, such as crane hooks, rigging, and load bars; tool cabinets; and other items. Equipment is provided to handle casks shipped in either the vertical or horizontal orientation. For horizontal casks, equipment is provided to pivot the cask to the vertical unloading position and back again.

The north decon room is 16 ft (north to south) by 18 ft (east to west) and is 22 ft high. The south decon room is 15 ft (north to south) by 18 ft (east to west) and is 17 ft high. These rooms are located on the west side of the cask receiving and decontamination area, directly south of Unloading Pool 2 and Isolation Pool 2. The rooms are constructed of concrete and are lined with stainless steel. The 1-ft-thick concrete walls and roof provide shielding for the work performed in these rooms, which consists of contamination control, cask venting, decontamination, maintenance on contaminated items, and coolant collection.

Access into the decon rooms is through the hydraulically operated horizontal doors in the ceilings, manually operated vertical doors in the east wall of each room, the main front doors, or the personnel door located in the back (west) wall of each room. Access to the upper level of each decon room is provided by an external stairway and by fixed ladders inside the decon rooms.

Airflow is directed through the decon rooms to the exhaust air plenum. The sealed doors and walls and directed airflow minimize the potential release of contamination or airborne radioactivity from the decon rooms. A grate platform around the upper-level perimeter of each room allows access to the top portion of a cask. This platform is 13 ft 6 in. high in the north decon room and 8 ft 6 in. high in the south decon room. The space available to work on a cask is approximately 9 ft (north to south) by 12 ft 6 in. (east to west) by 21 ft high for the north decon room and approximately 8 ft (north to south) by 12 ft 6 in. (east to west) by 16 ft high for the south decon room.

Approximately 250 ft² of office and storage space is also provided at the south end of the cask receiving and decontamination area between the roll-up doors. This space was provided by enclosing a portion of the area with walls and a ceiling.

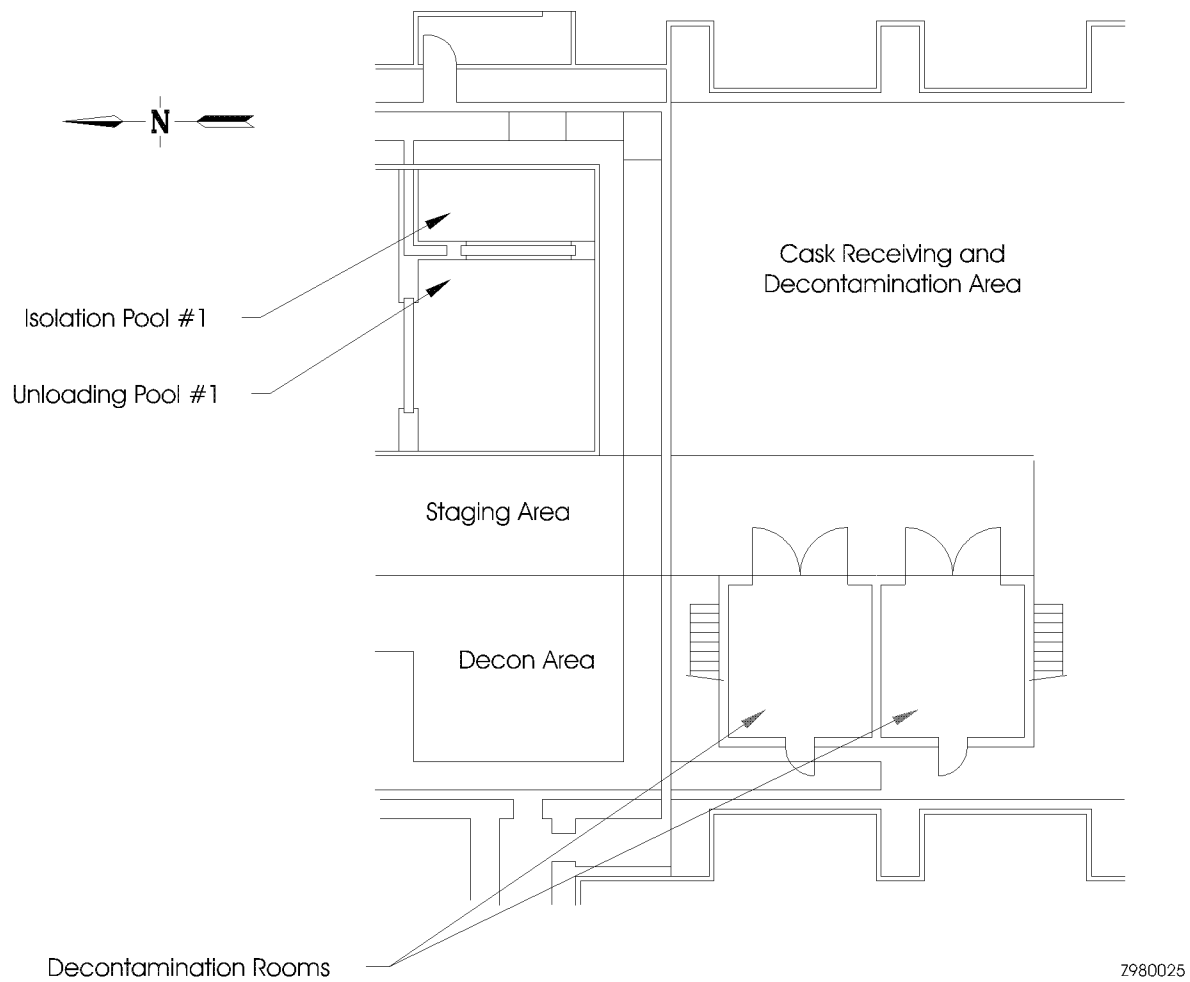
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Figure 2-6. FSA cask receiving and decontamination area.

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2.4.1.3 Fuel Unloading Area. The fuel unloading area, located between the cask receiving and decontamination area and the fuel storage pools, contains two cask unloading pools and two isolation pools. This area provides space for the fuel to be unloaded, inspected, and packaged (or repackaged if necessary). The unloading pools provide a location for underwater staging of casks. Fuel is unloaded from casks, or inserted into casks in the unloading pools. The adjacent isolation pools provide a location for fuel leak testing. The area is illustrated in Figure 2-7. The cask unloading and isolation pools are constructed of concrete and lined with stainless-steel plate. There is a 1-in.-thick carbon-steel plate between the pool liner and the concrete floor in each unloading pool. Casks are unloaded under water, and the fuel is transferred to the fuel storage pools via the transfer channel.

Unloading Pool 1 is 36 ft deep, 19.75 ft wide (east to west), and 19 ft long (north to south), resulting in a floor area of about 375 ft². The associated isolation pool is 31 ft deep, 19 ft long (north to south), and 8 ft wide (east to west) and has a floor area of 152 ft². Unloading Pool 2 is 44 ft deep, 19.75 ft wide (east to west), and 24 ft long (north to south), with a floor area of 474 ft². Its isolation pool is 41 ft deep, 24 ft long (north to south), and 8 ft wide (east to west), with a floor area of 192 ft².

Two 10-ton fuel handling cranes (CRN-FS-901 and -902) and extended-reach tools are used in this area for removing fuel from the casks and for transferring the fuel to the storage pool area. The 130-ton crane (CRN-FR-903) that is used in the cask receiving and decontamination area is also used in the fuel unloading area to transfer the casks into and out of the unloading pools. The fuel handling cranes are discussed further in Section 2.5.2.1, and the pool area that can be accessed by the cranes is also identified in that section.

The walls between the unloading pools and the associated isolation pools have openings that allow the use of removable gates. These gates are intended to isolate the individual pools (the unloading pool from its associated isolation pool) and to restrict the spread of contamination from pool to pool. It is also possible to isolate the unloading pools from the transfer channel with the gates as shown in Figure 2-7 by the location of the gate openings. The Unloading Pool 1 gate opening extends 20 ft below grade, and the width tapers from 11 ft 1 in. at the top, to 6 ft 8 in. at the bottom. The gate opening for Unloading Pool 2 extends 23 ft 9 in. below grade, and the width tapers from 11 ft 1 in. at the top, to 6 ft at the bottom. The pool gates are described in Section 2.5.2.7.

2.4.1.4 Fuel Storage Pool Area. The fuel storage pool area is shown in Figure 2-8. The six interconnected fuel storage pools, divided by concrete walls, contain the underwater fuel storage racks. Each pool measures 31 ft (north to south) by 46.5 ft (east to west), resulting in a floor area of approximately 1,442 ft² for each pool. Pools 1 and 2 are 41 ft deep and Pools 3, 4, 5, and 6 are 31 ft deep; nominal water depths are 40 and 30 ft, respectively. Each fuel storage pool has a gate opening on the east wall that provides access to the transfer channel. The gate opening for Pools 1 and 2 extends 23 ft 9 in. below grade, and the width tapers from 11 ft 1 in. at the top, to 6 ft at the bottom. The opening for the remaining pools extends 20 ft below grade and the width tapers from 11 ft 1 in. at the top, to 6 ft 8 in. at the bottom. The pool gates are described in Section 2.5.2.7. (Note: These gate opening dimensions are clearance values; pool gates and slots are wider.)

The entire fuel storage pool area is constructed of reinforced concrete, and each pool is lined with stainless steel. Fuel storage racks are placed in each of the six fuel storage pools. As mentioned previously, two 10-ton fuel handling cranes (CRN-FS-901 and -902) are used in the storage pool area to move fuel; these cranes are described in Section 2.5.2.1.

2.4.1.5 Fuel Cutting Pool Area. The FSA includes a fuel cutting pool area located north of the storage pools that consists of a cutting pool and its associated control room (shown in Figure 2-8). The fuel cutting pool area is inactive and has never been operated, and, as shown in Figure 2-8, the control room is used as a shift office.

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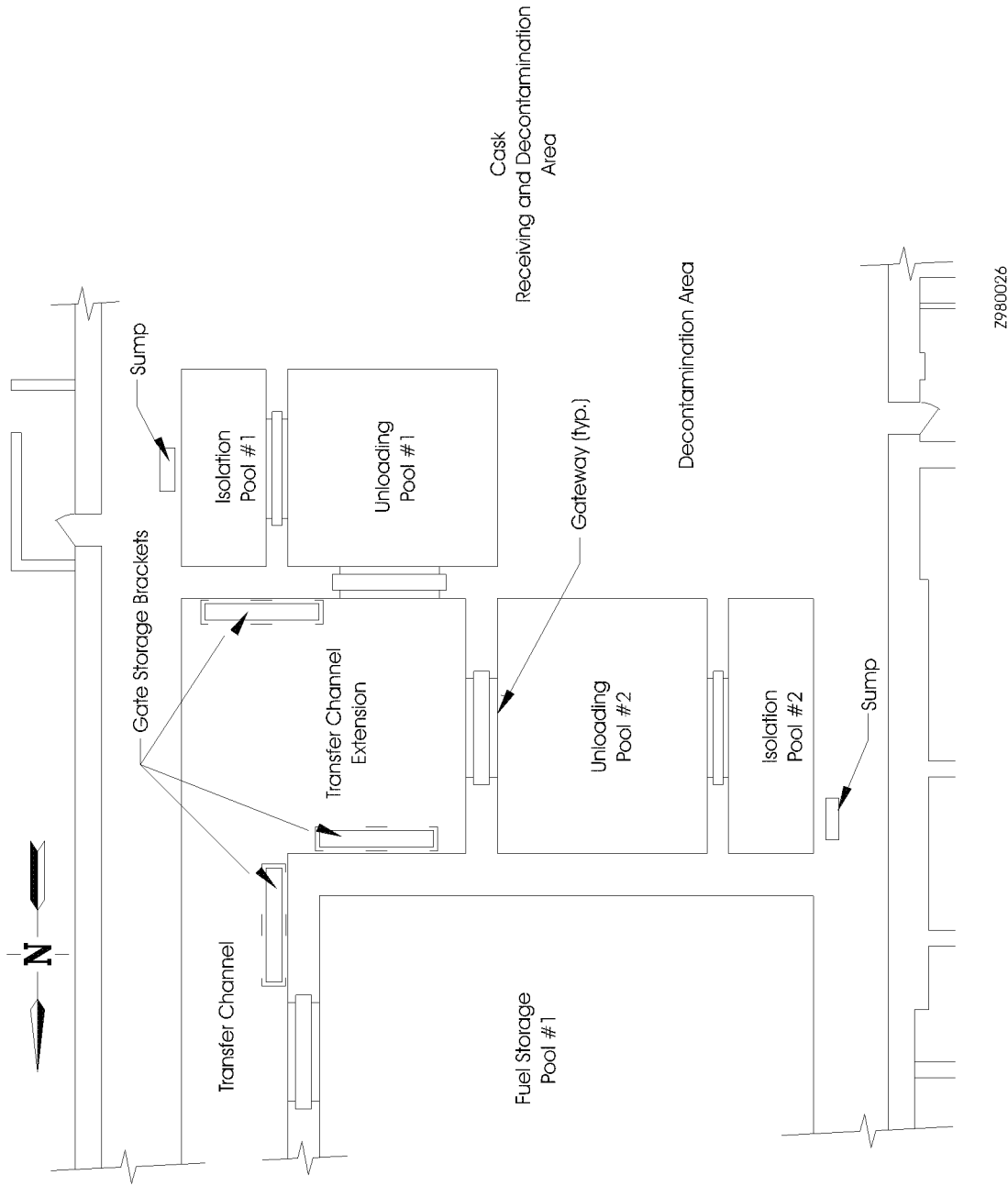


Figure 2-7. FSA unloading and isolation pools floor plan.

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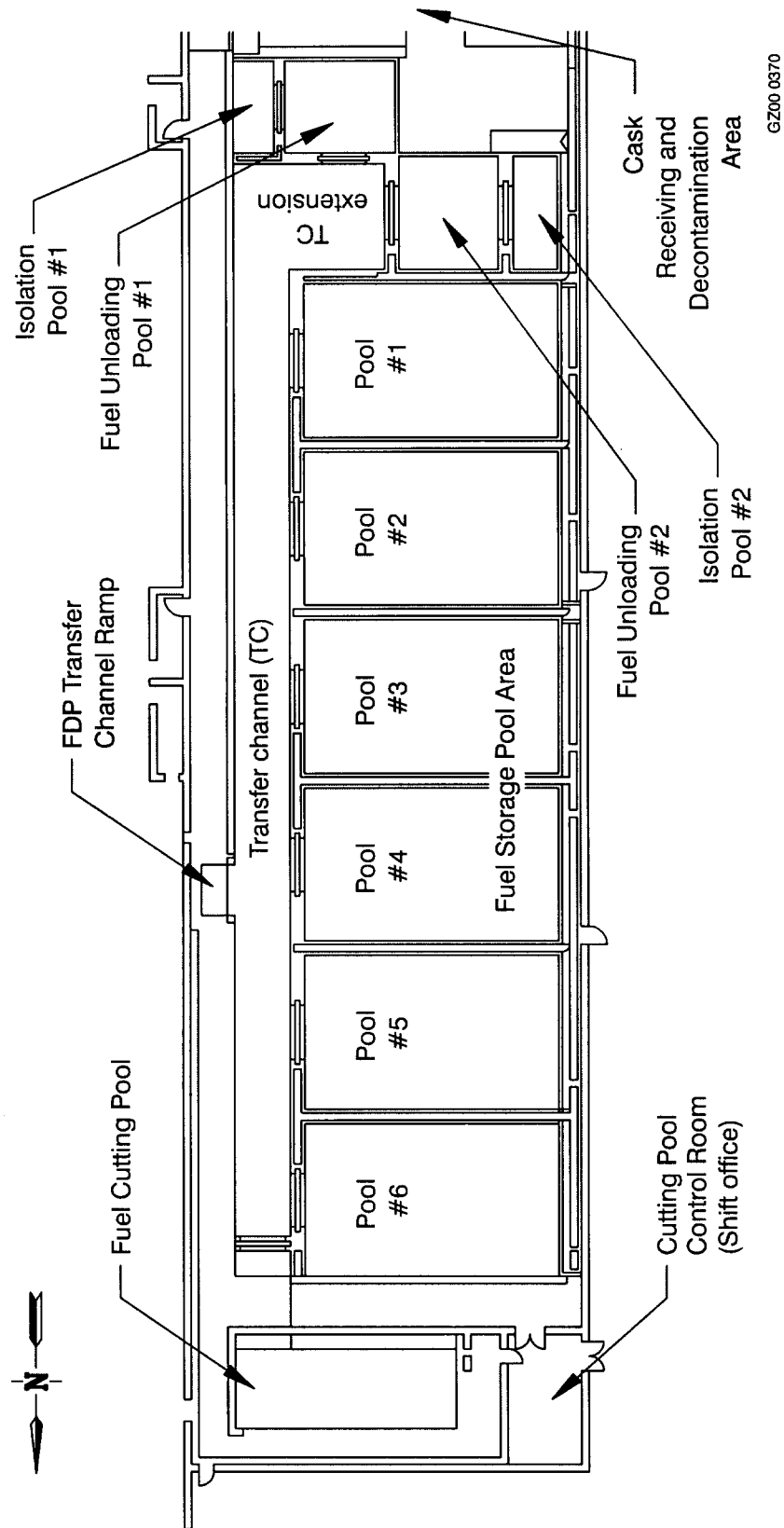


Figure 2-8. Fuel storage pool area.

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This area was constructed so that fuel could be retrieved from storage, cut, or otherwise prepared for processing, and temporarily stored until reprocessed in the FDPA. The area allotted for this function is approximately 27 ft long north and south and 69 ft wide east and west. The actual pool floor area, which is 16 ft wide by 43.5 ft long, is 696 ft². The pool, constructed of reinforced concrete and lined with stainless steel, is 31 ft deep. The nominal water depth, when filled, is 30 ft.

As shown in Figure 2-9, access to the cutting pool is provided by two underwater transfer carts. (Similar carts also were used to move fuel to the FDPA, see Section 2.5.2.3). A 5-ton fuel handling bridge crane (CRN-FS-904) is available for handling fuel and equipment. The cutting pool can be isolated from the transfer channel by the use of a gate that is 9 ft 7 in. wide at the top and tapers to 6 ft 1 in. at the bottom. The gate is 19 ft 6 in. tall. (See Section 2.5.2.7). Other than the transfer carts, crane, and crane test weight, no major equipment or fuel is contained within the cutting pool area.

The cutting pool control room is approximately 24 ft wide (north to south) by 16 ft long (east to west). Although the room was designed to control remote fuel cutting operations conducted in the cutting pool, it is used as a shift office instead. The fuel cutting pool and control room are isolated from each other by an interior wall.

2.4.1.6 Transfer Channel. A transfer channel is located north of the unloading and isolation pools and east of the storage pools. The 10-ft-wide channel extends the entire length of the storage pools (approximately 196 ft) plus approximately 24 ft north of the north side of the cutting pool gate opening. The transfer channel is 31 ft deep and is constructed of reinforced concrete and lined with stainless steel. The location of the transfer channel area has been shown previously in Figure 2-8. The transfer channel links the fuel storage pools together. Fuel moving to and from the pools is transported through the transfer channel. A ramp opposite Pool 4 from the transfer channel provides underwater access to the FDPA.

2.4.1.7 Water Treatment Area. The water treatment area is a multilevel area located west of the fuel storage pools that occupies an area of approximately 19,960 ft². The various levels are illustrated in Figure 2-10. This area houses the basin water recirculation and treatment systems. The water treatment area is structurally divided into seven shielded equipment cells, six shielded pipe areas and a pump corridor, and nonradioactive support areas.

The water treatment area design provides two sections, based on the potential for radiation exposures. The section with essentially no expected radioactive material inventories contains the ultraviolet light system (used to control microorganism growth), the deionized water (DW) makeup system (inactive), the regeneration skid for the basin ion-exchange system (inactive), acid storage vessels (inactive), a chiller, a propylene glycol cooling system, and two liquid waste drain systems that connect to existing INTEC liquid effluent systems. The section with potential for radioactive material inventory contains cells for the basin water filters, ion-exchange vessels, spent resin and process equipment waste collection vessels, a remotely operated waste loadout cell (inactive), shielded pipe areas, a pump corridor, operating areas, and a decontamination solution makeup and chemical storage area (not generally used).^b

b. The systems noted as inactive in this paragraph are not used. Regeneration of the ion exchange resins, use of the waste transfer cask, and filter solids handling are not authorized by this DSA. Use of the other inactive systems is not specifically prohibited, provided such use does not involve chemicals.

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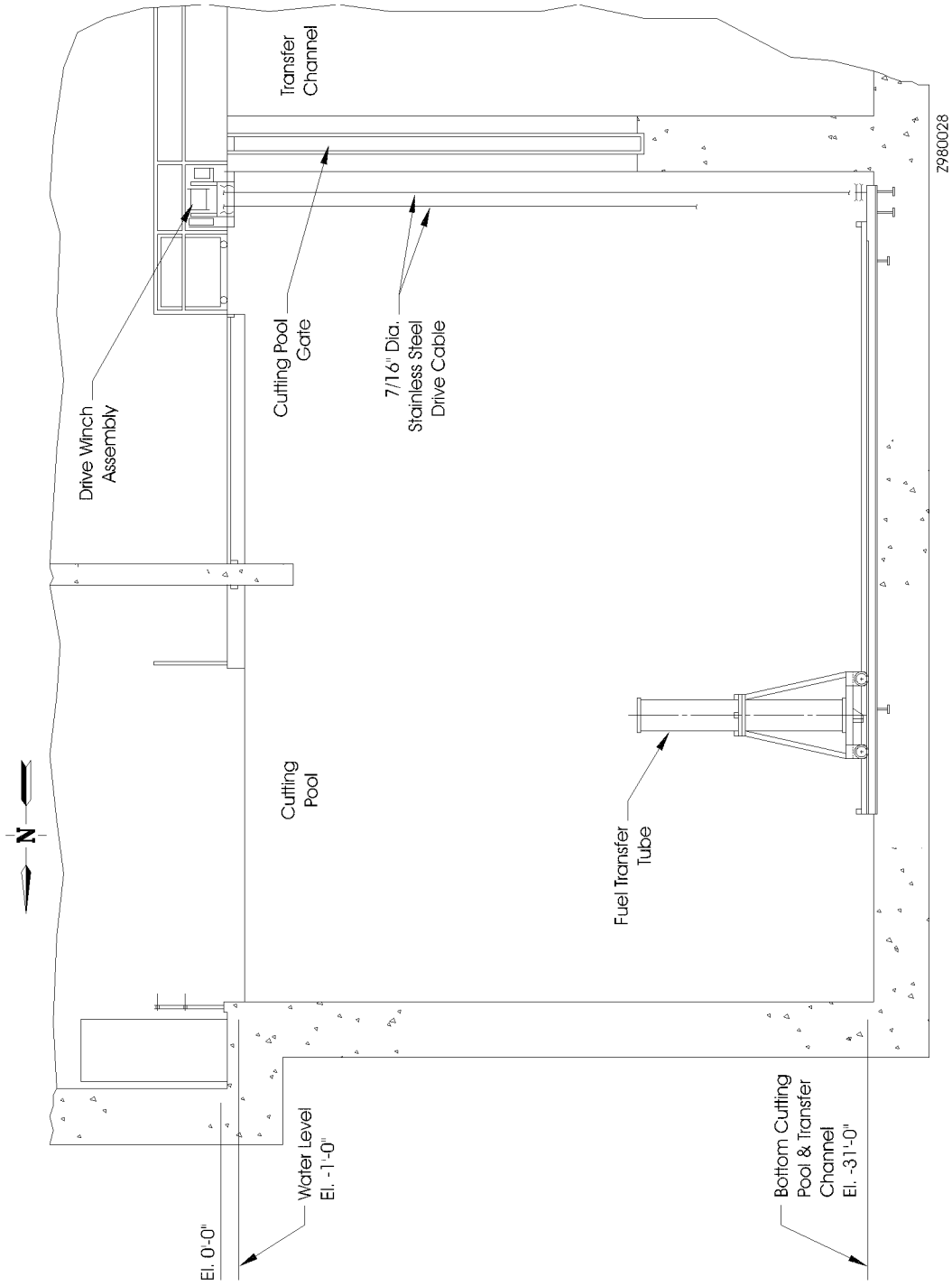


Figure 2-9. Cutting pool-underwater transfer system (elevation).

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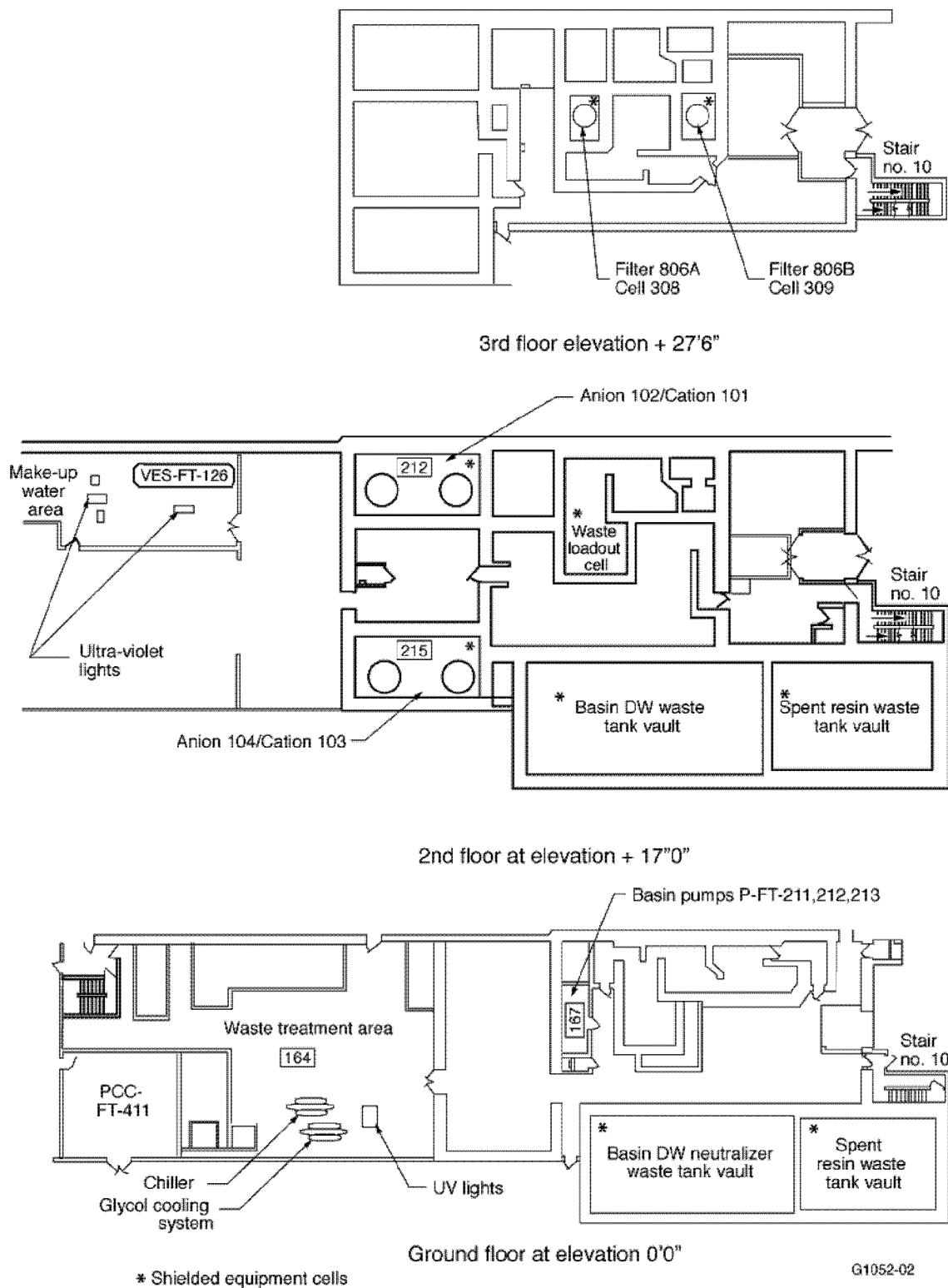


Figure 2-10. FSA water treatment area.

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2.4.1.8 Transfer Channel Extension. The transfer channel extension is a part of the transfer channel described previously. It is located at the south end of the transfer channel and extends west to connect the transfer channel with the unloading pools. The transfer channel extension is approximately 24 ft north and south and 26 ft 9 in. east and west, for a total area of approximately 642 ft². This extension, like the transfer channel, is 31 ft deep and has been shown previously in Figure 2-8. Because it is a continuation of the transfer channel and is a part of it, both the transfer channel and the transfer channel extension are referred to as the transfer channel in the remainder of this SAR.

2.4.1.9 Main Control Room (Shift Operating Base). The main control room, which is located at the north end of CPP-666 at ground level, contains the shift operating base area (see Figure 2-4). It has two entrances and a floor area of 1,700 ft². The room was designed for control of the operator-intensive FDPA process and for selective monitoring of the FSA. The FDPA process is inactive since fuel processing operations have ceased. The room has the capability for monitoring and controlling the CPP-666 HVAC system, water treatment functions, utility functions, and certain area radiation monitoring instruments.

2.4.1.10 HVAC Support Areas. The HVAC support areas provide space for the equipment described in Section 2.5.6. These areas consist of five separate rooms located above the offices and other support areas at the northwest end of CPP-666 (see Figure 2-11). These rooms house the following supply and exhaust equipment:

- Supply air mechanical equipment room (Room 210)—a 113-ft by approximately 38-ft room, occupying an area of 4,319 ft². This room houses the CPP-666 supply air fans, prefilters, air heating and cooling coils, stack monitoring controls and equipment, supply air washers, and local control panel.
- Exhaust air mechanical equipment room (Room 208)—an L-shaped room occupying an area of 7,492 ft². This room contains the exhaust fans, the final prefilters and HEPA filters, stack particulate sampling equipment, fire protection chamber, heat recovery coils, and local control panel.
- Dissolution cell and fuel cutting pool exhaust mechanical equipment room (Room 207)—a 24-ft by 37-ft 3-in. room, occupying an area of 894 ft². This room contains the cutting pool supply air filters and fan, the cutting pool exhaust filters, and a common set of fans for the cutting pool and the FDPA cell exhaust air.
- Water treatment exhaust air mechanical equipment room (Room 211)—a 21-ft by 52-ft room, occupying an area of 1,092 ft². This room contains the filters and fans used to pretreat and handle the exhaust air from the water treatment area shielded cells, tank vaults, pipe chase, and the waste loadout cell.
- Mechanical equipment room for control room (Room 204)—a 19-ft 7-in. by 15-ft 6-in. room, occupying an area of 304 ft². This room contains the main control room supply air fan, the recirculation fan, and the heating and cooling coils for conditioning the shift operating base air.

2.4.1.11 Miscellaneous Support Areas. In addition to the functional areas described in the previous sections, the FSA also contains offices, storage rooms, restrooms, change rooms, showers, and electrical equipment rooms. These support areas occupy various spaces within the FSA, as shown previously in Figure 2-4. The primary functions of these areas are to provide offices for support and operating personnel and change rooms for contamination control.

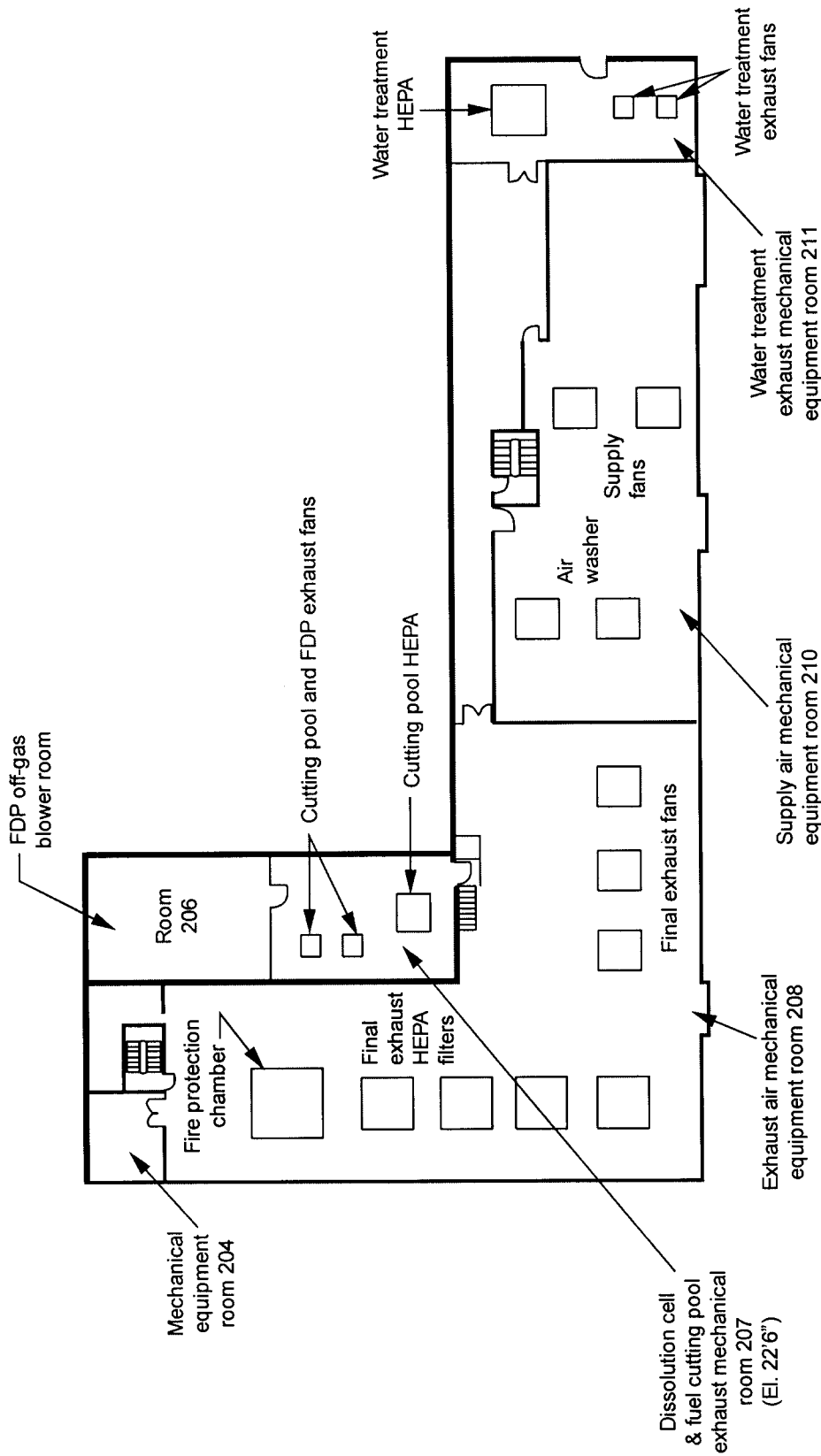
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Figure 2-11. Layout of FSA HVAC support area.

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2.4.1.12 FDPA Interfaces. The FDPA and its supporting areas account for approximately 41,000 ft² of CPP-666. Details specific to FDPA interfaces are discussed in SAR-126. The hazard evaluation in Chapter 3 identifies hazardous events for the FSA. These hazardous events (such as fire, radiation exposure, ventilation, radioactive material releases including loss of pool water, and criticality) are also considered with respect to effects on the adjacent FDPA and are discussed in SAR-126. FDPA hazards (such as fire, radiation exposure, ventilation, and radioactive material releases) are insignificant (do not exceed evaluation guidelines) with respect to FSA operations due to the nature of the material-at-risk and potential hazardous event initiators. Although the FDPA is inactive, the following FDPA structures or systems interface or are shared with the FSA:

- FDPA transfer channel ramp—This transfer channel ramp is perpendicular to and intersects the FSA transfer channel opposite Fuel Storage Pool 4 (see Figure 2-8). The FDPA transfer channel contains an underwater transfer cart system (inactive). A moveable cover is positioned over the transfer channel interface in the FDP cell.
- Main control room (now used as the shift operating base)—This room houses the controls for both the FDPA and the FSA (see Section 2.4.1.9).
- Dissolution cell and fuel cutting pool exhaust mechanical equipment room—This room contains HVAC equipment for the FDPA dissolution cell and the fuel cutting pool (see Section 2.4.1.10).
- CPP-666 HVAC system—The HVAC system serves both the FDPA and the FSA facilities (see Section 2.5.6). This system includes Room 206, which contains the off-gas blowers for the FDP cell vessels (see Figure 2-11).
- Water treatment and management systems—The FDPA transfer channel is a continuation of the FSA transfer channel and is therefore supported by the water treatment and management systems (see Section 2.5.4).
- Wall between the FDPA and the FSA—This wall also provides shielding from fuel being handled in the FSA transfer channel to workers in the FDPA basement areas.
- Utility, auxiliary, and support systems—Utility distributions, auxiliary systems, and support facilities including electrical power, water, steam, sewer, plant air, breathing air, nitrogen generation, cold chemical systems, communications and alarms, and fire protection (see Sections 2.8 and 2.9) are common to both areas.

2.4.2 Facility Structural Design

This section discusses the structural design of the FSA with respect to withstanding postulated design or evaluation basis natural phenomena and potential operational loads important to the safety analysis. Sections 2.4.2.1 through 2.4.2.6 summarize the FSA structural design for natural phenomena. Specific operational loads and associated design criteria for FSA structures are presented in Section 2.4.2.7. The original structural design criteria are presented; the effects of design criteria changes since construction of the FSA are reviewed; and the results of subsequent re-analyses of the FSA structural design are discussed. The original FSA design criteria are contained in ENI-104² and met the applicable design codes, standards, regulations, and DOE directives at the time.

Natural phenomena hazards (threats) pertinent to the FSA design are identified in Table 1-1 of Chapter 1, “Site Characteristics,” along with the original and current design and evaluation criteria for each hazard. A summary of the original seismic and extreme wind design basis for FSA structures is provided in Table 2-1. A summary of the original seismic design basis for FSA systems and components is provided in Table 2-2.

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Table 2-1. Summary of the original seismic and extreme wind design basis for FSA structures.

Elevation	Structure	Seismic	Extreme Wind
-44 ft 0 in.	Fuel Unloading Pool 2 bottom	DBE ^a	NA ^b
-44 ft 0 in. to 0 ft 0 in.	Fuel Unloading Pool 2 walls	DBE	NA
-41 ft 0 in.	Isolation Pool 2 bottom	DBE	NA
	Fuel Storage Pools 1 and 2 bottom	DBE	NA
-41 in. 0 in. to 0 ft 0 in.	Isolation Pool 2 walls	DBE	NA
	Fuel Storage Pools 1 and 2 walls	DBE	NA
-36 ft 0 in.	Fuel Unloading Pool 1 bottom	DBE	NA
-36 ft 0 in. to 0 ft 0 in.	Fuel Unloading Pool 1 walls	DBE	NA
-31 ft 0 in.	Fuel Storage Pools 3–6, Isolation Pool 1, transfer channel, and fuel cutting pool bottom	DBE	NA
-31 ft 0 in. to 0 ft 0 in.	Fuel Storage Pools 3–6 walls	DBE	NA
	Isolation Pool 1 walls	DBE	NA
	Transfer channel walls	DBE	NA
	Transfer channel ramp walls	DBE	NA
	Fuel cutting pool walls	DBE	NA
-21 ft 0 in. to +21 ft 5 in.	Basin DW neutralizer waste tank vault	OBE ^c	NA
-13 ft 0 in.	Water treatment area pump corridor	OBE	NA
-3 ft 6 in. to +21 ft 5 in.	Spent resin waste tank vault	OBE	NA
0 ft 0 in. to +17 ft 0 in.	Shield walls	OBE	HYW ^d
	Water treatment area	OBE	HYW
0 ft 0 in. to +28 ft 0 in.	Support areas	OBE	HYW
	Truck receiving area	UBC ^e	UBC
+17 ft 0 in. to +28 ft 0 in.	Process support area	OBE	HYW
	Water treatment area	OBE	HYW
	Mechanical equipment area	OBE	HYW
	Shield walls	OBE	NA
-28 ft 0 in. to 46 ft 6 in.	Water treatment area	OBE	HYW
0 ft 0 in. to +39 ft 6 in.	Upper fuel storage area	DBE	DBT ^f
0 ft 0 in. to +61 in.	Cask receiving area walls	DBE	DBT
	Upper fuel unloading area (extent of CRN-FR-903 structure that partially overlaps Fuel Storage Pool 1)	DBE	DBT
Exterior	Other walls	OBE	HYW
	Doors and windows	Same as walls	Same as walls
	Exterior tornado doors	UBC	Same as walls
Exterior	Roof over storage and cask unloading area	DBE	DBT
	Stack	UBC	UBC
	CPP-767 pad	OBE	NA

- a. DBE design basis earthquake
b. NA not applicable
c. OBE operating basis earthquake
d. HYW 100-year wind
e. UBC Uniform Building Code
f. DBT design basis tornado

Note: The pool isolation gates are also DBE-qualified.

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Table 2-2. Summary of the original seismic design bases for FSA systems and components.

System	Seismic
<u>Water Treatment and Management</u>	
Water Treatment and Regeneration	OBE
Water Leakage Sumps	OBE
Water Treatment Filtration Backwash	OBE
Spent Resin Transfer and Storage	OBE
Water Treatment Regeneration Makeup	UBC ^a
Water Makeup	UBC ^a
<u>Waste Management</u>	
Cask Decontamination and Coolant Collection	UBC ^a
Radioactive Solid Waste Collection	OBE
Radioactive Solid Waste Disposal ^b	OBE
Radioactive Liquid Waste Collection and Disposal	OBE
<u>Utilities</u>	
Air Systems:	
Plant Air	UBC ^a
Instrument Air ^c	UBC ^a
Breathing Air	UBC ^a
Nitrogen ^c	UBC
Steam and Condensate	UBC
Water Systems:	
Raw Water	UBC
Potable Water	UBC
Deionized Water	UBC
Firewater Loop	UBC ^d
Treated Water	UBC
<u>Material Handling Systems</u>	
Fuel Storage Racks	DBE
Fuel Handling Bridge Cranes ^e	DBE
Fuel Handling Bridge Crane Supports ^f	DBE
Cask Handling Crane ^e	DBE
Cask Handling Crane Supports ^f	DBE
Underwater Transfer to Cutting Pool	OBE
Underwater Transfer to FDPA	OBE

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Table 2-2. (continued).

System	Seismic
Resin Waste Containers	— ^g
Other Casks (for filters, contaminated equipment)	— ^g
Fuel Handling and Cask Bails	— ^g
<u>Heating, Ventilation, and Air Conditioning (HVAC) Systems</u>	
Filters to Contaminated Cells	OBE
Components Between Potentially Contaminated Areas and Building Exhaust System	OBE
Building Exhaust System	OBE
Stack	UBC
Other HVAC Supply	UBC
<u>Electrical Systems</u>	
Standby Power Supply ^h	OBE
Uninterruptible Power Supply ^h	OBE
Normal Power ^h	UBC
<u>Instrumentation and Control Systems</u>	
Radiation Monitors	OBE
Evacuation Alarms	OBE
Fire and Security Alarms	UBC ⁱ
Continuous Air Monitors	UBC
Other Instrumentation	UBC
Other Radioactively Contaminated Systems	OBE
Nonradioactively Contaminated Fluid Systems	UBC

- a. UBC, Table 23-J, 4.c. Seismic requirements apply to supports and anchors of items whose toppling or collapse could obstruct corridors or exits.
- b. The solid waste disposal system includes the remote mechanical carts and transfer mechanisms.
- c. All systems dependent on instrument air or nitrogen are designed to fail-safe upon loss of air or nitrogen.
- d. The firewater system must meet National Fire Protection Association (NFPA) requirements.
- e. Cranes, manipulators, and trolleys must not be allowed to fall from their support during a DBE, but need not be operational. The crane bridge and trolley include devices that hold them on the rails.
- f. Supports include the concrete support for the rails, rail clips, and anchors.
- g. Must meet requirements for RWMC and/or on-site handling.
- h. Standby and normal power are now the same equipment, with a switch linking the equipment to the source. Several sources of uninterruptible power supply (UPS) are now used, each a part of the system they serve.
- i. UBC, Table 23-J, 4.d. Seismic requirements apply to "life safety" equipment and equipment anchors and supports.

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In the design report of the FSA, load combinations are described by the architectural engineer (AE).¹⁷ Load combinations included dead loads (including water pressure), live loads (including snow, soil pressure), wind loads, tornado loads, and seismic loads. There are no groundwater hydrostatic loads.

Equipment derived loads on structures were limited to dead loads and seismic loads since no plant upset, emergency, or faulted conditions were specified; and loads from normal operation, such as pipe pressure reaction, are much smaller than seismic loads.

Based on a comparison between the original facility design criteria and the current criteria, the FSA design meets those for a Performance Category (PC)-3 facility.

2.4.2.1 Extreme Wind Design. The original FSA design criteria for extreme wind loadings are summarized in Table 1-1 and include:

- Normal wind conditions per the Uniform Building Code (UBC)
- The 100-year wind (HYW) (100 mph)
- The DBT and associated tornado-generated missiles.

Table 1-1 also summarizes the current design criteria for extreme wind loadings at the INEEL. The current extreme wind design criteria for a PC-3 facility are an 84-mph wind and associated wind-generated missiles.^c The original FSA design criteria for extreme winds are more stringent than current PC-3 design criteria. Therefore, the original wind design basis of the FSA provides adequate protection from the effects of extreme wind conditions. The extreme wind design basis for specific FSA structures is summarized in Table 2-1.

2.4.2.2 Volcanic Design. Volcanic hazards include lava flow, ground deformation (fissures, uplift, subsidence), volcanic earthquakes, and ash flows or airborne ash deposits. The most recent and closest volcanic eruption occurred 2,100 years ago at Craters of the Moon, 15 miles southwest of the INEEL.¹⁸ The potential for future volcanic activity at the INEEL is extremely unlikely.¹⁸ No design criteria are specified for volcanic hazards in either the original facility design criteria or the present criteria (see Table 1-1).

2.4.2.3 Lightning Design. The number of lightning strikes occurring at the INEEL is not high.¹⁸ However, due to the lack of natural targets for lightning discharge and the poor conductivity of the lava rock and desert soil, manmade structures are highly susceptible to lightning strikes. The FSA structure was designed and constructed to meet the requirements of the Lightning Protection Code of the NFPA.¹⁹ Although a revision of the code has been issued, it is not applicable to the original design of the FSA.

2.4.2.4 Flood Design. The FSA was designed for a probable maximum flood (PMF) with a 10,000-year recurrence interval. The PMF has the potential to result in water level at 4,916.6 ft above mean sea level assuming a 35,000-ft³/s flood crest. The present PMF design criteria are the same as that specified in the original facility design criteria. Flood protection for FSA equipment and structures is provided by the following features:

c. As discussed in SAR-100, Chapter 1, "Site Characteristics," tornado design criteria are no longer required for the INEEL.

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- Entrances to the FSA are located above the expected PMF elevation, at elevation 4,917.0 ft or higher.
- The liquid effluent systems contain check valves to prevent backflow through discharge piping during flood conditions. There are also manual isolation valves that would be closed in the event of a flood.
- All belowgrade equipment is located in concrete cells. The tops of the cell walls are above the PMF elevation.

In addition to the PMF criteria, the current design criteria also includes a 25-yr (recurrence interval), 6-hr storm that results in 1.4 in. of rainfall. The potential hazard is localized flooding. Protection against localized flooding is provided by the INTEC site drainage system.

2.4.2.5 Snow Design. The FSA was originally designed for a snow loading of 30 lb/ft², which is also the current design criterion.

2.4.2.6 Seismic Design. The FSA was designed to the seismic criteria presented in Table 1-1. The seismic criteria used in the FSA design were equivalent to that later defined for a high hazard facility use category.^d The facility was otherwise classified as a moderate hazard facility in accordance with the DOE Order 5481.1B (“Safety Analysis and Review System”) classification system that preceded the now-current system per 10 CFR 830, Subpart B²⁰ and DOE-STD-1027-92.²¹ Tables 2-1 and 2-2 list the seismic design basis (DBE, OBE, or UBC) for FSA structures, systems, and components (SSCs).

The current seismic design criteria are also presented in Table 1-1. Except for the differences in soil amplification factors, and the absence of an OBE criterion, the original facility seismic design criteria are similar to the PC-4 criteria.

A re-evaluation of the FSA structural capacity was conducted to support an increase in the FSA fuel storage capacity by reracking of selected pools. Reracking provides new fuel storage racks and adds fuel storage capacity, both of which result in an increased load on the pool floors. The loads used in the original design analysis¹⁷ and the reracking analysis²² are presented in Table 2-3. These loads are exclusive of water, which imposes a 2,496 lb/ft² load for a 40-ft depth of water or a 1,872 lb/ft² load for a 30-ft depth of water.

Table 2-3. Comparison of FSA storage rack and fuel loads – original design analysis versus reracking analysis.

Original Design Loads		Reracking Analysis Loads	
Pools 1 and 2	450 lb/ft ²	Pools 1, 2, 3, 4, 5, and 6	1,800 lb/ft ²
Pools 3, 4, 5, and 6	300 lb/ft ²	—	—
Cutting pool	NA	Cutting pool	1,800 lb/ft ²
Transfer channel	100 lb/ft ²	Transfer channel ^a	450 lb/ft ²

a. An increased floor loading for the transfer channel was included in the reracking analysis to support relocation of the original racks to the transfer channel and their use as interim storage while reracking of Pool 1 was performed. Water is not included in the load values.

d. High hazard and moderate hazard facility use categories are defined in UCRL-15910, “Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena Hazards,” June 1990.

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The reracking analysis used the original seismic design criteria for high hazard facilities and included three general cases.

1. Every pool, including the cutting pool, was full of water; and a static/gravity load combination.
2. Same as above, except Pools 2 and 5 were completely empty (no water, racks, or fuel); static/gravity load combination.
3. Same as Number 1 above, except a dynamic/seismic load combination was used.

The empty pool (Number 2 above) was included in the reracking analysis since the use of pool gates and associated pool draining operations were features included in the original FSA design.

From the results of the reracking analysis²² it was concluded that the structural capacity of the pool floors was adequate for the reracking loads. However, the reracking analysis indicated that there were overloads associated with the FSA structure that affected other areas. These overloads resulted from errors in the original facility design calculations and increased loading assumptions in the reanalysis.^{22,23,24} The overloads, expressed in terms of demand-to-capacity ratios, D/C, are compiled in Table 2-4. The overload locations (keyed to Table 2-4) are shown in Figure 2-12. When D/C ratios are less than or equal to 1.0, the design criteria are met at the particular location being evaluated. D/C ratios greater than 1.0 indicate that the facility design criteria are not met.

Because of the calculated overloads obtained in the initial reracking analysis results, additional nonlinear calculations were performed to resolve the overloads in those areas associated with reracking. These results are presented in Table 2-5.²²

A summary of the disposition of the overloads identified by the reracking analysis (see Table 2-4) is provided in Table 2-6. Disposition of the overloads is based on the additional nonlinear analysis results in Table 2-5 (quantitative analysis) and qualitative argument (engineering judgment).²⁵ In the absence of complete resolution of the calculated overloads (see Table 2-6), an operating restriction is imposed that prohibits draining of water from any of the pools to create empty pools. The operating restriction is derived from the hazards evaluation in Chapter 3. This operating restriction will remain in place until additional structural and seismic analyses are performed that demonstrate that the FSA meets the present structural and PC-3 seismic criteria for such load cases. The cutting pool, in particular, has already been reanalyzed as discussed below.

The cutting pool had been empty of water for most of the facility operating history, and, as shown in Table 2-6, was overloaded in that condition. In 1997, additional calculations were performed to specifically address the cutting pool overloads.²⁶ As compared to the reracking analysis discussed previously, this analysis only addressed the cutting pool for the static load combination and filled with water. The results are listed in Table 2-7, and the locations are shown in Figure 2-13. These results, and the previous finding of overloads in this area, provided the basis for concluding that the cutting pool should be filled with water to eliminate the overloads (see Table 2-6). On the basis of the 1997 analyses, the cutting pool was filled with water in October 1999. The operating restriction prohibiting draining of pools also applies to the filled cutting pool.

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Table 2-4. FSA calculated overloads (D/C ratios exceeding 1.0).

Facility Component	Item No. ^a	Description of Location ^a	Static/Gravity Loading Cases, D/C	Dynamic/Seismic Loading Cases, D/C
			Load Combination $U = 1.4D + 1.7L$ $+ 1.7H$ Pools 2 and 5 empty ^b	Load Combination $U = D + L + H$ $+ T_a + E$ All pools full ^c
Pool 2 Basemat	1	West Side Line J (flexure) about N/S axis	A 1.91 ^d	
	2	Mid-Span (flexure) about N/S axis	B 1.05 ^d	
	3	East Edge (Gate) Top steel in tension (flexure) about N/S axis		C 1.07 ^e
	4	Mid-Span Top steel in tension (flexure) about E/W axis		D 1.05 ^e
	5	North Side (flexure) about E/W axis	E 2.59 ^d	F 2.53 ^f
	6	West Edge (flexure) about N/S axis; this effect also seen in Pool 1		G 2.86 ^f
	7	South Side (flexure) about E/W axis	H 1.22 ^d	
Pool 3 Basemat	8	South Edge (flexure) about E/W axis		I 1.42 ^f
Transfer Channel Basemat at Elevation -31, Pool 2	9	East Wall (out of plane shear)		J 1.17 ^e
Cutting Pool Basemat	10a	North Side (flexure) about E/W axis	K 1.23 ^g L 2.16 ^{dh}	M 1.10 ^f
	10b	North Side (flexure) about E/W axis	N 2.25 ⁱ (empty cutting pool)	O 5.4 ⁱ (empty cutting pool)

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Table 2-4. (continued).

Static/Gravity Loading Cases, D/C		Dynamic/Seismic Loading Cases, D/C		
Facility Component	Item No. ^a	Description of Location ^a	Load Combination $U = 1.4D + 1.7L$ $+ 1.7H$ Pools 2 and 5 empty ^b	Load Combination $U = D + L + H$ $+ T_a + E$ All pools full ^c
	11	At Wall (out of plane shear)	P 1.82 ^{dh}	
	12	Mid-Span Top steel in tension (flexure) about E/W axis	Q 1.13 ^e	
	13	Mid-Span Top steel in tension (flexure) about N/S axis	R 1.07 ^e	
Exterior Basemat	14	Between Buttresses E12 and E13 at Wall, without ties (out of plane shear)	S 1.10 ^e	
Definitions				
D/C	demand to capacity ratio			
U	total demand on structural members			
D	demand due to dead loads			
L	demand due to live loads			
H	demand due to lateral static earth pressure loads			
T _a	demand due to faulted temperature gradients			
E	demand due to DBE seismic loads			
See Table 2-6 for cross-reference of large alpha labels on D/C values above.				
Notes:				
a. Item numbers are keyed to Figure 2-12 which shows the locations of the overloads.				
b. Unless otherwise noted (see g, h, and i). Pools 2 and 5 are assumed empty for these cases (no water, fuel, or racks), and the cutting pool is assumed to be full of water.				
c. In these cases, all pools, including the cutting pool, are assumed to be full of water.				
d. Source - Reference 22 (AEC Job No. 1002-01 Report Table 6).				
e. Source - Reference 22 (AEC Job No. 1002-01 Report Table 13).				
f. Source - Reference 22 See Table 2-5 for additional details.				
g. Source - Reference 22 (AEC Job No. 1002-01 Report Table 5). Note b does not apply; this result is for all pools full.				
h. Source - Reference 22 (AEC Job No. 1002-01 Report Section 5.5). These results are for an empty cutting pool (contrary to Note b), using simplified hand calculations.				
i. Source - Reference 24.				

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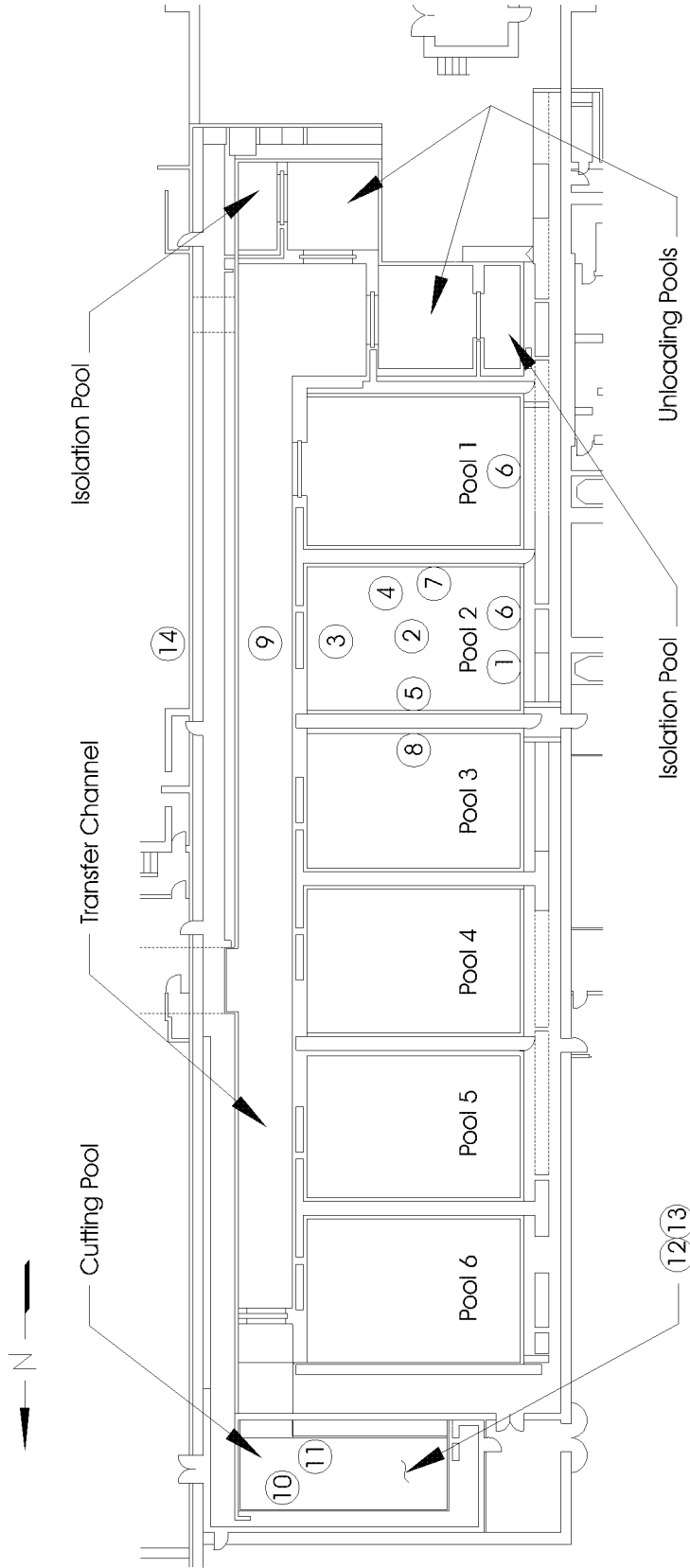
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Note: Circled numbers are keyed to items in tables 2-4 and 2-5.

0'-0" Level FAST Facility Plan

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Figure 2-12. Locations of FSA calculated overloads.

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Table 2-5. Resolution of calculated dynamic/seismic overloads associated with reracking using nonlinear analysis techniques.

Overload Location ^a		Demand Capacity Ratio, D/C		
Facility Component	Item No. ^b	Linear Analysis ^c	Nonlinear Analysis ^{d,e}	
			Steel Strain	Concrete Strain
Pool 2 Basemat	5	2.53	0.05	0.12
	6	2.86	0.06	0.13
Pool 3 Basemat	8	1.42	0.05	0.12
Cutting pool Basemat	10a	1.10	0.08	0.15

a. See Table 2-4 for additional details on overload description and location.

b. Item numbers keyed to Figure 2-12, which shows the locations of the overloads.

c. These linear analysis results are reported in Table 2-4 for dynamic/seismic cases, assuming all pools, including the cutting pool, full of water.²²

d. In these calculations, a hinge was assumed at the affected locations. Steel and concrete strains are calculated for the hinge rotation. The ratio is calculated strain to allowable strain.²²

e. See Table 13 in Reference 22. In terms D/C ratios, the nonlinear results are much less than 1.0. Contrary to the corresponding linear D/C values, the nonlinear results indicate that these locations of the facility possess adequate strength for the specified load combination.

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Table 2-6. Disposition of calculated overloads.

Alpha Labels ^a	Disposition
A, B, E, and H	These D/C ratios range from 1.05 to 2.59; static load combination; empty fuel storage pool load case. Since draining of pools is prohibited, these D/C ratios are not applicable.
C, D, J, and S	These D/C ratios are relatively small, and range from 1.05 to 1.17; seismic load combination. The D/C ratios were determined using the SRSS ^b method, and lower values would likely have resulted if the algebraic summation method had been used. The AEC evaluation of the facility was accepted by the peer reviewer (EQE), deemed acceptable, and characterized as conservative. Reductions in the seismic load (by 10 to 20%), which would tend to reduce the D/C ratios, are allowed by DOE-STD-1020. In addition, the PC-3 criteria that are applicable to this facility (per the Chapter 3 accident analysis), imposes a seismic load 25% less than that of PC-4.
F, G, I, and M	These D/C ratios range from 1.10 to 2.86; seismic load combination. These D/C ratios were resolved (reduced to less than 1.0) by refined nonlinear analysis methods. The results of the additional analysis are presented in Table 2-5.
K, L, N, O, P, Q, and R	These D/C ratios range from 1.07 to 5.4; ^c static and seismic load combinations. Since the cutting pool is filled with water, the L, N, O, and P D/C ratios in excess of 1.0 do not apply. The full pool load case, static load combination D/C ratio (K) was resolved by additional analysis (see Table 2-7). The D/C ratios (Q and R) for the full pool case, seismic load combination, were deemed acceptable based on engineering judgment. Additional analysis of these D/C ratios without conservatism (rerack loads and coarse mesh) would reduce the ratios to less than 1.0 since the exceedences are small.

a. The alpha labels are those used in Table 2-4.

b. SRSS stands for square root sum of the squares.

c. It is not expected that the very large D/C ratio of 5.4 could be significantly reduced by refined, rigorous analysis techniques (qualitatively or quantitatively). Facility modifications may be needed to reduce 5.4 sufficiently for the empty pool case.

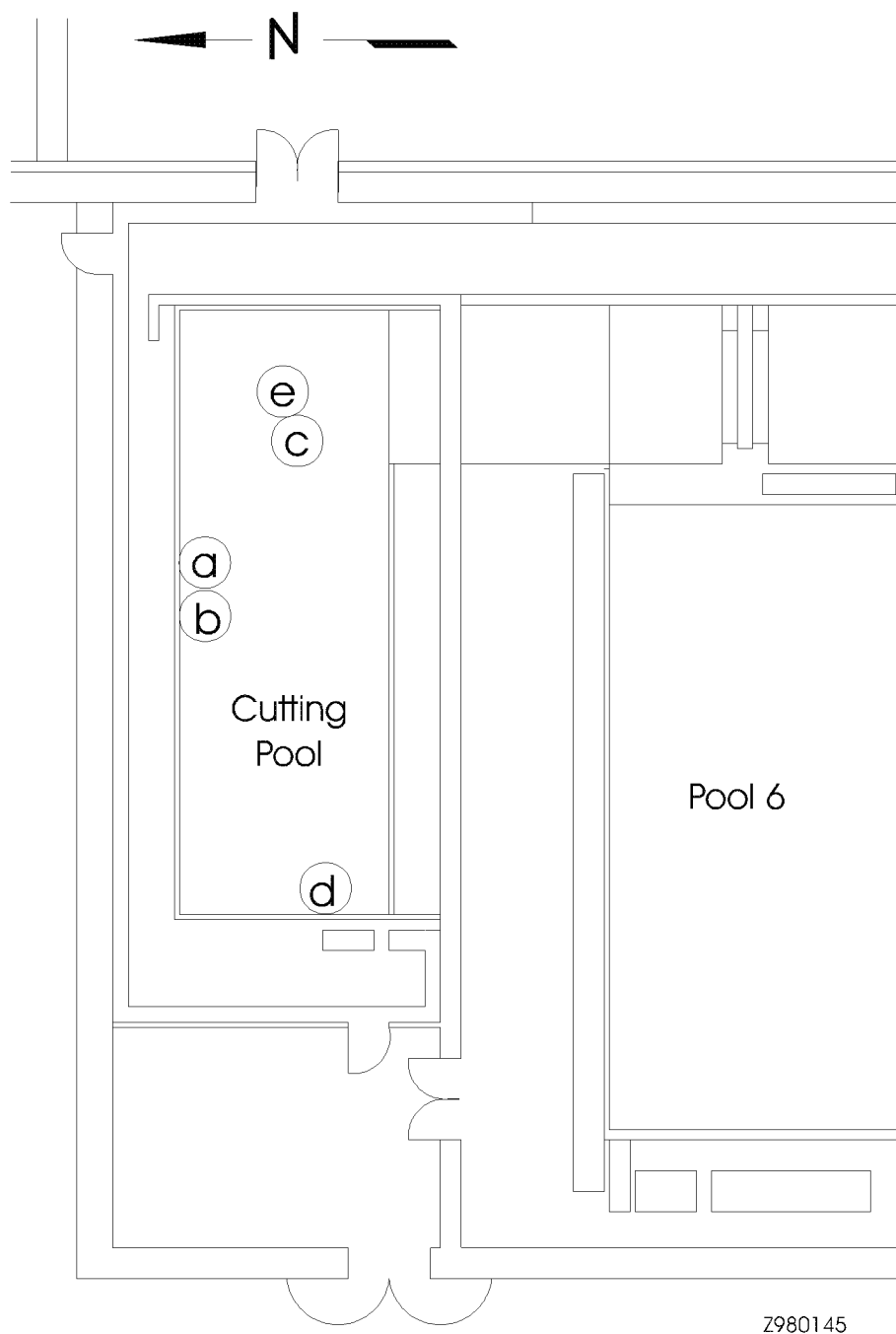
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Figure 2-13. CPP-666 FSA cutting pool–spotting map D/C ratios from capacity reanalysis.

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Table 2-7. CPP-666 cutting pool basemat analysis, pool filled with water, gravity analysis, load combination $U = 1.4D + 1.7L + 1.7H$.

Location/Response	D/C Ratios	Item ^a
Out of plane shear	0.63	a
North side, flexure about E-W axis, tension at bottom	0.86	b
Center, flexure about E-W axis, tension at top	0.25	c
West side, flexure about N-S axis, tension at top	0.37	d
Center, flexure about N-S axis, tension at bottom	0.12	e

a. These items, a, b, c, etc., are keyed to locations on a spotting map of the cutting pool, as shown in Figure 2-13.

In 1998, an issue arose regarding the use of the System for Analysis of Soil-Structure Interaction (SASSI) code for seismic analyses at INTEC.²⁷ The concern was misapplication of the code; the code itself did not contain an error. Initially, the CPP-666 FSA was thought to be one of the affected INTEC facilities. The SASSI issue was thought to affect (increase) seismic analysis results, D/C ratios, by a factor of 1.2 to 2.5.²⁸ In the case of the FSA, that factor would have resulted in the identification of new overloads for the facility for the seismic load combination and the full pool case. Further examination of the FSA seismic analyses indicated that the suspect modeling technique had not been used in the FSA SASSI analyses.²⁹

2.4.2.7 Operational Loads. In addition to providing protection against postulated design or evaluation basis natural phenomena, the structural design of the FSA provides the capability to withstand operational loads, including normal loads and impact or drop loads. The operational design loads important to the safety analysis are discussed below. Structural details of the FSA (floor and wall thicknesses and dimensions) supporting the summaries of operational load design criteria are shown in Figures 2-14, 2-15, 2-16, and 2-17.

1. **Truck Receiving Area.** This area is sized to accommodate two tractor-trailer combinations 10 ft wide by 77 ft long, each weighing 195 ton.² The floor is a 1-ft 8-in.-thick reinforced concrete slab on compacted granular fill.
2. **Cask Receiving Area.** Similar to the truck receiving area, the cask receiving area is also sized to accommodate two tractor-trailer combinations. The floor is designed to support the combined weight of two 195-ton shipments, and two casks (7-ft-diameter) weighing up to 126 ton.² The cask receiving area floor is a 12-in.-thick (minimum) reinforced slab over compacted granular fill.
3. **Fuel Unloading Pool 1.** The floor of Unloading Pool 1 is designed to withstand the drop of a 65-ton cask.² The floor is an 8-ft-thick reinforced concrete slab with a 1-in.-thick carbon-steel plate on the top surface. The design drop is from the highest attainable crane hook height.^e

e. In practical terms, this means that the hook height corresponds to the minimum stackup of 36 ft (for Unloading Pool 1) or 44 ft (for Unloading Pool 2) that allows setdown of the cask on the respective unloading pool floors.

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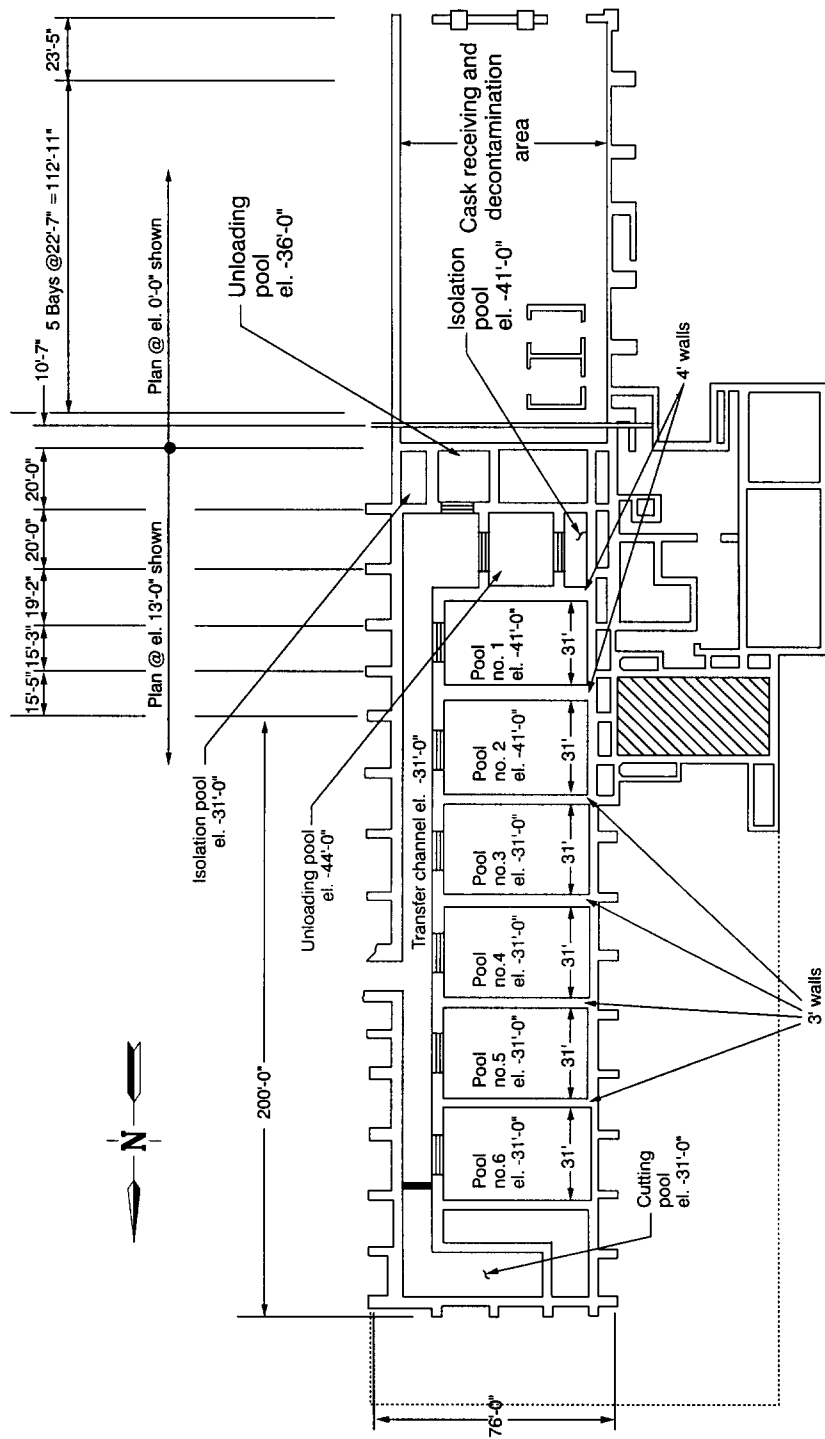
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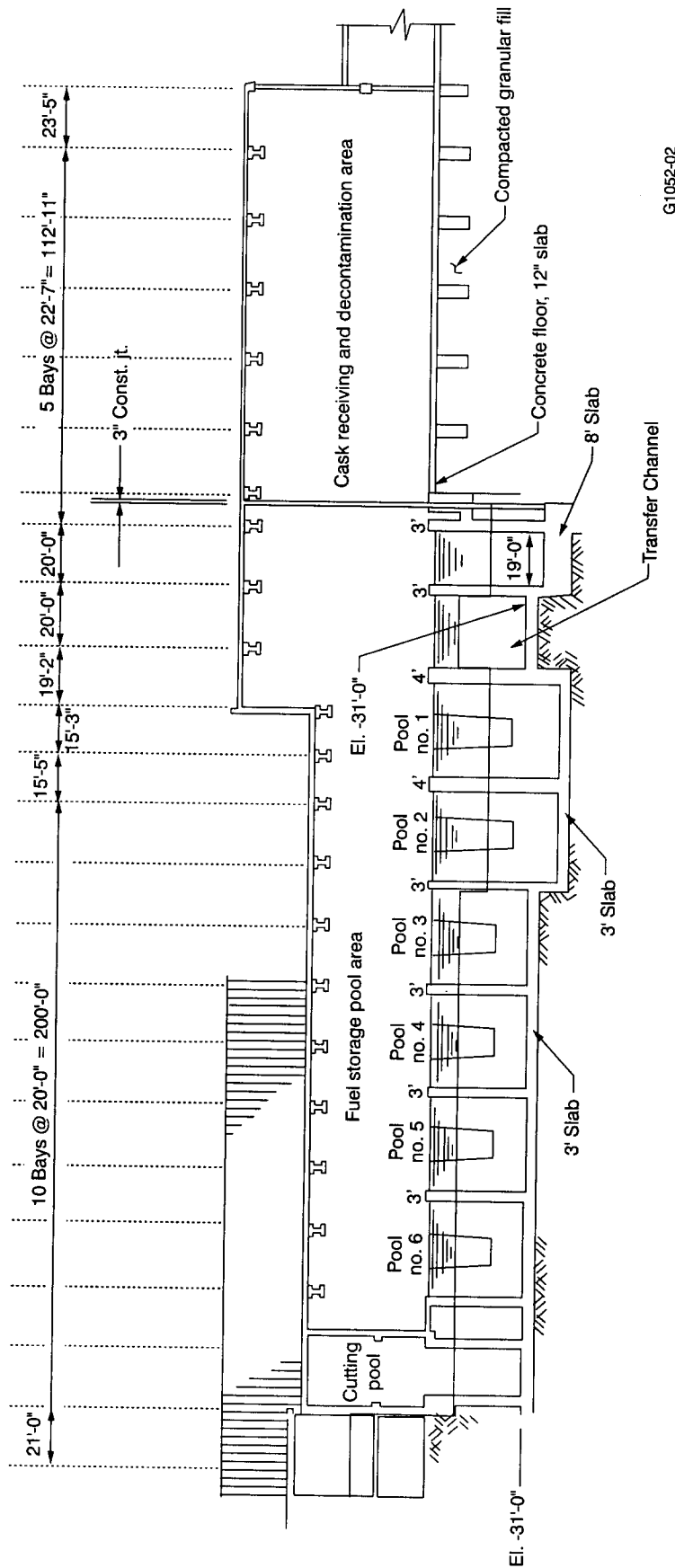
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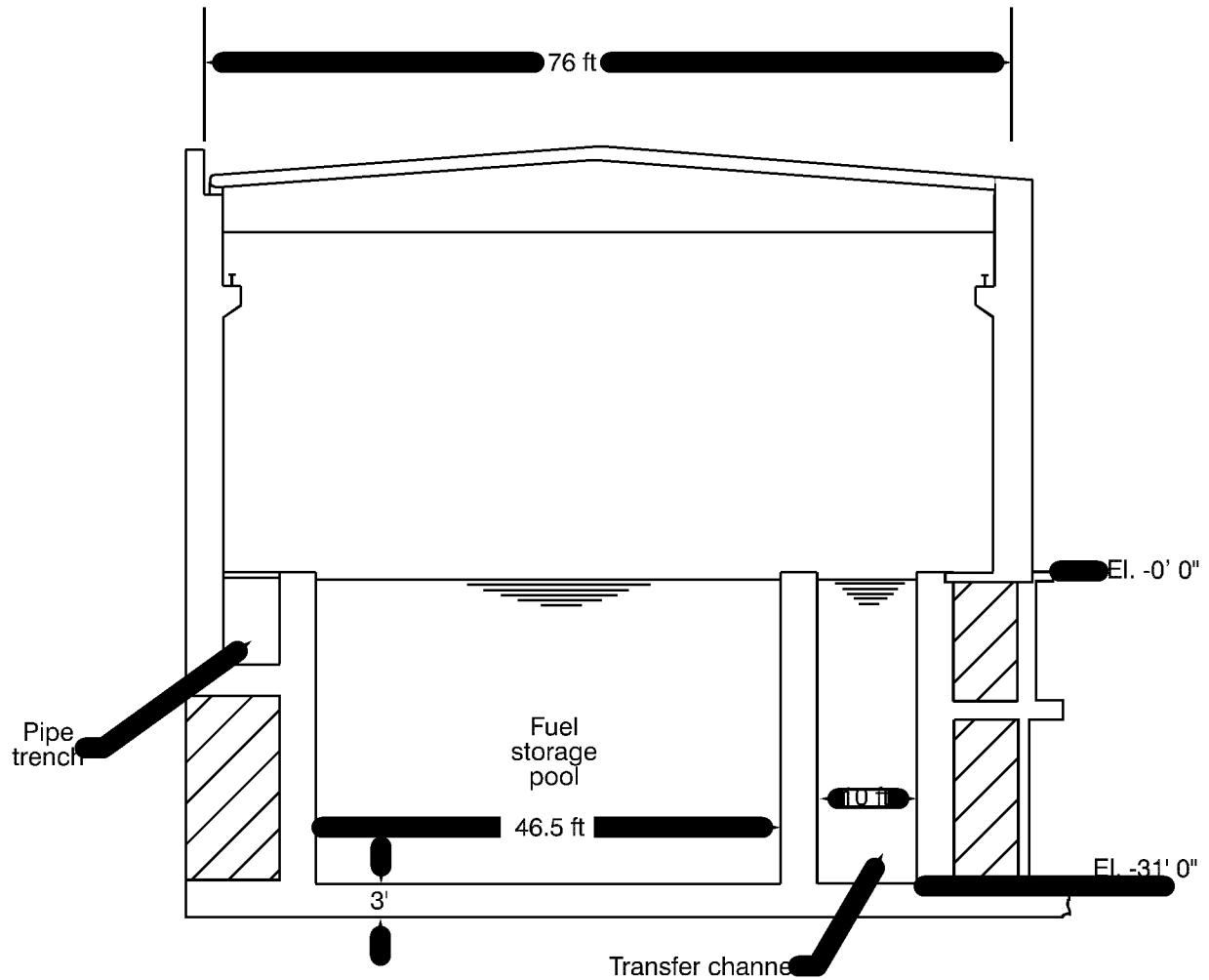
Figure 2-14. FSA floor plan.

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Figure 2-15. FSA section plan.

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Figure 2-16. FSA east-west section at shallow pools.

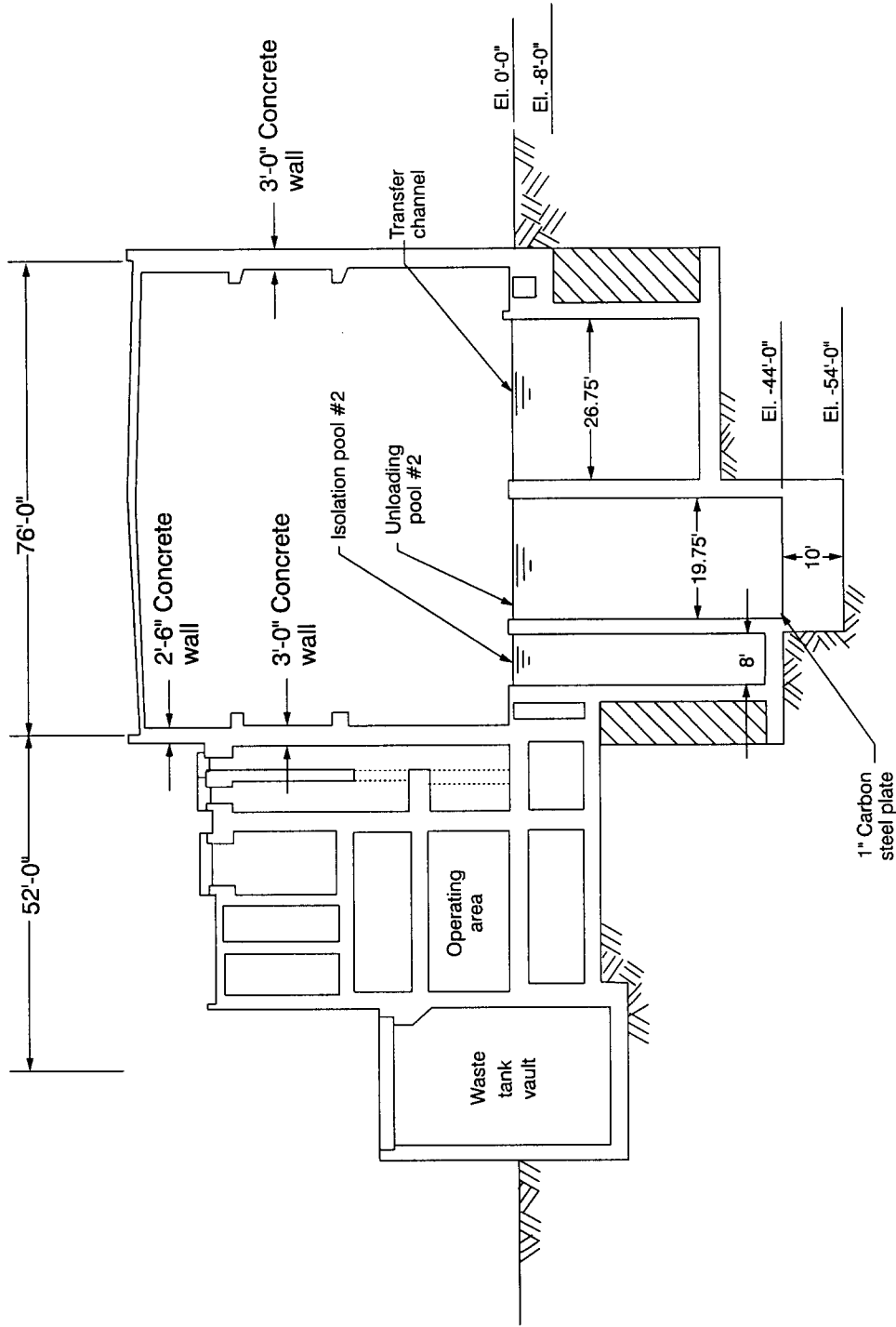
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Figure 2-17. FSA east-west section at Unloading Pool 2.

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4. Fuel Unloading Pool 2. The floor of Unloading Pool 2 is designed to withstand the drop of a 100-ton cask.² The floor is a 10-ft-thick reinforced concrete slab with a 1-in.-thick carbon-steel plate on the top surface. The design drop is from the highest attainable crane hook height.^e
5. Fuel Storage Pools, Cutting Pool, Isolation Pools, and Transfer Channel. The floors of the fuel storage, cutting, and isolation pools, and the floor of the transfer channel are designed to withstand dropped objects, specifically, fuel (2,600 lb), racks, and pool gates. These floors are 3-ft-thick reinforced concrete.

2.4.3 Casks

Irradiated fuel is transported in casks that are received at the FSA or are used to ship irradiated fuel from the FSA. There are many different casks designed to transport different types of fuel. The only casks authorized for handling and loading/unloading at the FSA are as follows:

- Advanced Test Reactor (ATR) Spent Fuel Element Transfer Cask (hereinafter referred to as the ATR cask)
- Peach Bottom Casks CA-SF-005 and CA-SF-006 (for purposes of this SAR the two Peach Bottom casks are considered to be identical and are hereinafter referred to as the Peach Bottom cask).

A description of the ATR cask is provided in Section 2.4.3.1. A description of the Peach Bottom cask is provided in Section 2.4.3.2.

2.4.3.1 ATR Cask. The ATR cask, Transfer Cask Support Pallet, and Trailer E-71806 are used to transfer spent ATR fuel elements from the ATR, located at the Test Reactor Area (TRA), to the FSA. The ATR cask has been used to safely accomplish these transfers for over 20 years. With a transfer cask divider serving as a critically safe fuel element grid in the ATR cask cavity, a maximum of 8 ATR fuel elements may be transported in the ATR cask. A description of the ATR cask and the transfer cask divider is provided below. Additional details for the ATR cask are provided in the ATR cask transport plan.³⁰

The ATR cask consists of the following components:

Spent Fuel Element Transfer Cask Body - EG&G Drawing No. 120784
(ATR-1075-MTR-670-MS-107)

Spent Fuel Element Transfer Cask Support Pallet - EG&G Drawing No. 403682

Spent Fuel Element Transfer Cask Plug - EG&G Drawing No. 120783
(ATR-1075-MTR-670-MS-106)

Spent Fuel Element Transfer Cask Lid Retainer and Wrench - EG&G Drawing No. 421150

Spent Fuel Element Transfer Cask Divider - EG&G Drawing No. 408517.

The ATR cask has the following capacities and identification:

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Empty Weight: (Cask and basket) 26,500 lb^f

Capacity: 8 ATR fuel elements with transfer cask divider in cask

Equipment No.: 670-MSR-3525

Identification: Spent Fuel Element Transfer Cask
MFG. By: O.G. Kelley & Co., Inc., Boston, Mass.
FluorCorp, Ltd. Purchase Order 4079-40-115.

The ATR cask is shown in Figures 2-18, and 2-19. The cask body is a 35-in.-outside diameter by 74-5/8-in.-tall 3/8-in.-thick austenitic stainless-steel cylinder fitted with 1/2-in.-thick, 36-in.-diameter flanged and dished ASME-type stainless-steel heads. The inside cavity within the cask is formed by a cylinder of 1/4-in.-thick stainless steel, 12-3/4-in. inside diameter and 52-5/8 in. tall, and a 1/4-in.-thick plate on the lower end. Between the cavity liner and the outside wall, there is lead with a nominal thickness of 10-1/2 in. The area immediately above the cavity is designed to accept the cask plug (lid) which is a tapered lead-filled stainless-steel cylinder 11 in. tall and 18 in. in diameter at the bottom and 20-1/4 in. in diameter at the top. The cask plug has a 1/2-in.-thick top plate that, when installed on the cask body, allows two 1-3/4-in.-diameter threaded studs to pass through the plate. Nuts installed on the studs lock the cask plug in place.

A drain-and-fill system installed in the body of the cask allows water drainage through a normally plugged 1-in. stainless-steel gate valve and water additions through a funnel mounted at the top of the cask. The fill line is fitted with a level-indicating sight glass. The cask plug is fitted with a vent to prevent pressure buildup and allow proper operation of the system.

The cask body is fitted with a flat bottom base 47-1/2 in. by 49-1/4 in. in cross-section. The base is designed to allow transport of the cask with a straddle carrier. The two lifting trunnions are located 67 in. from the bottom of the cask body, diametrically opposite each other, with approximately 54 in. between lifting surfaces. These fixtures also serve as transport tie-down points.

The transfer cask divider (Figure 2-20) serves as a critically safe fuel element grid for the cask cavity. The overall dimensions are approximately 12-1/2 in. in diameter by 48-1/2 in. high. The divider consists of eight fin assemblies, 46-3/4 in. long by 3-1/4 in. wide by 0.177 in. thick, located and fitted radially from an aluminum center cylinder and resting on a bottom plate. The divider grid permits the loading of eight fuel elements arranged in an annular manner. A stainless-steel top plate holds the fins in place. The center cylinder is blocked off by a lifting pin attached to the top plate, which prevents the insertion of a fuel element in the center cylinder. The top plate is removable, allowing replacement of the fins. The fins contain a 0.085-in.-thick, 35 wt% B₄C Boral core for neutron absorption. The core is totally clad in aluminum.

The fill line, sight glass, closure devices, and other items are adequately protected by protective covers, or are located not to extend outside the structural outline of the cask.

f. Note that this weight differs from the name plate on the ATR cask. It is thought that the ATR cask originally used a shielded liner which increased the weight to approximately that on the name plate.

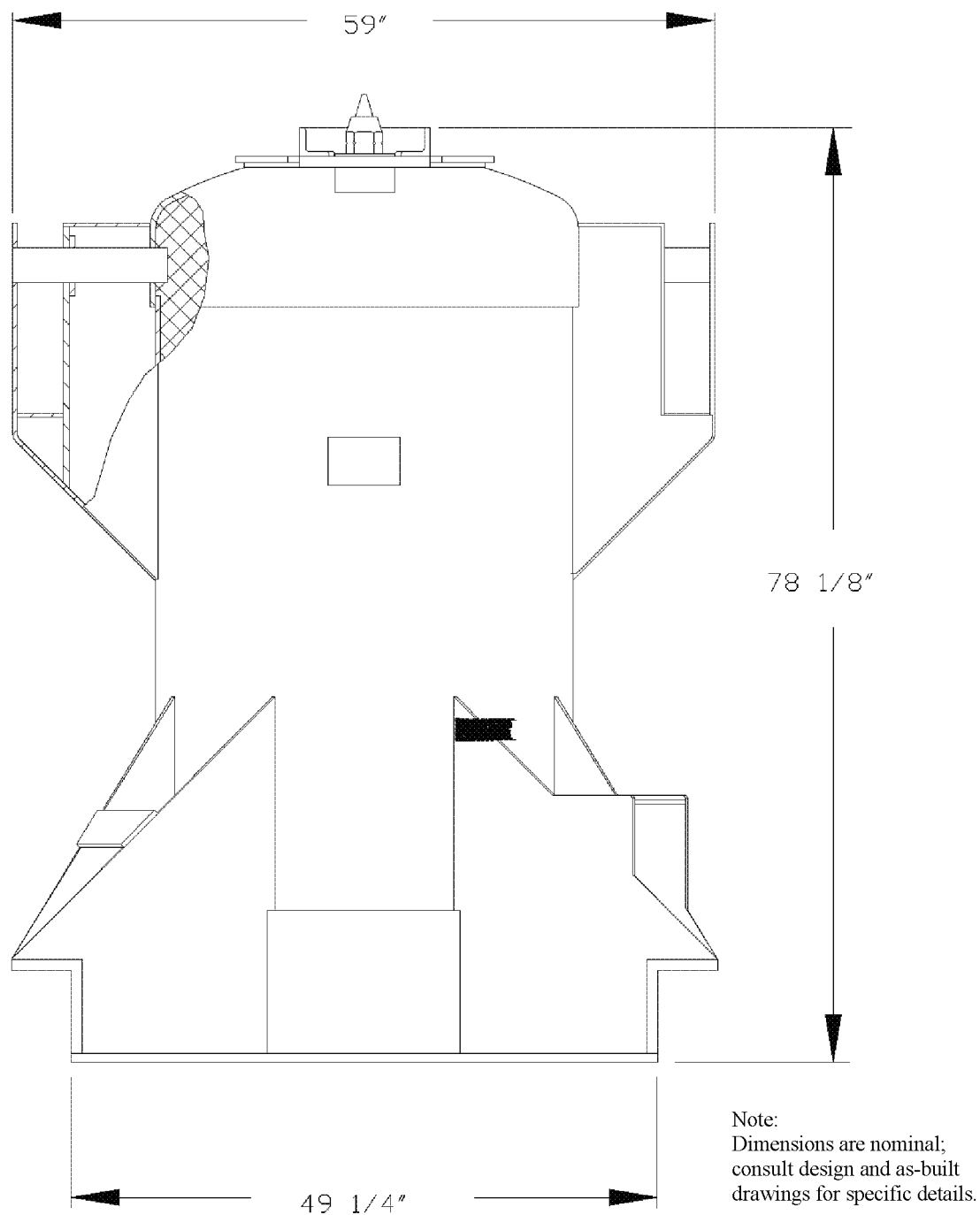
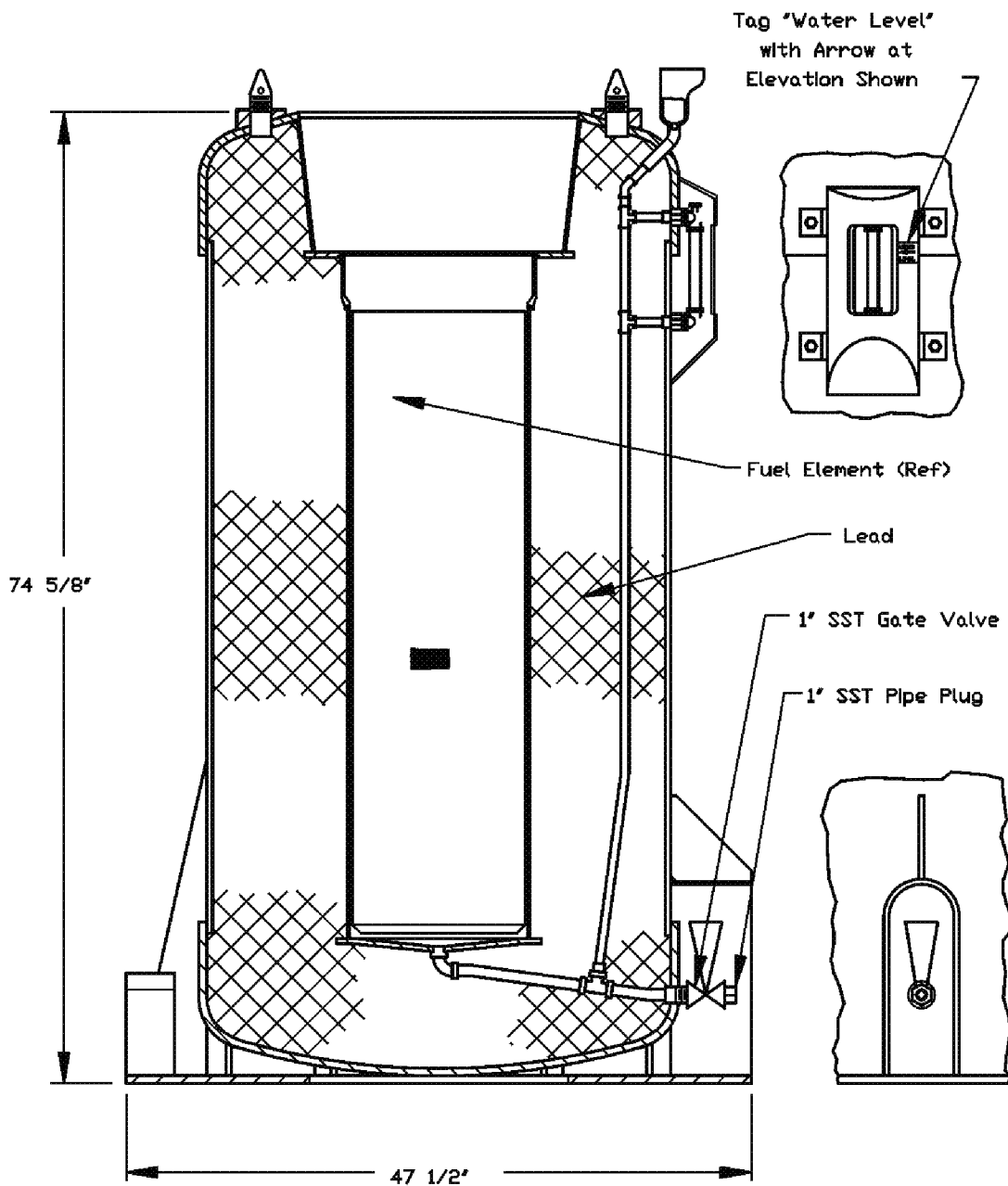
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Figure 2-18. ATR spent fuel element transfer cask.

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Note:
Dimensions are nominal;
consult design and as-built
drawings for specific details.

ATR Spent Fuel Element Cask

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Figure 2-19. ATR spent fuel element transfer cask cross section.

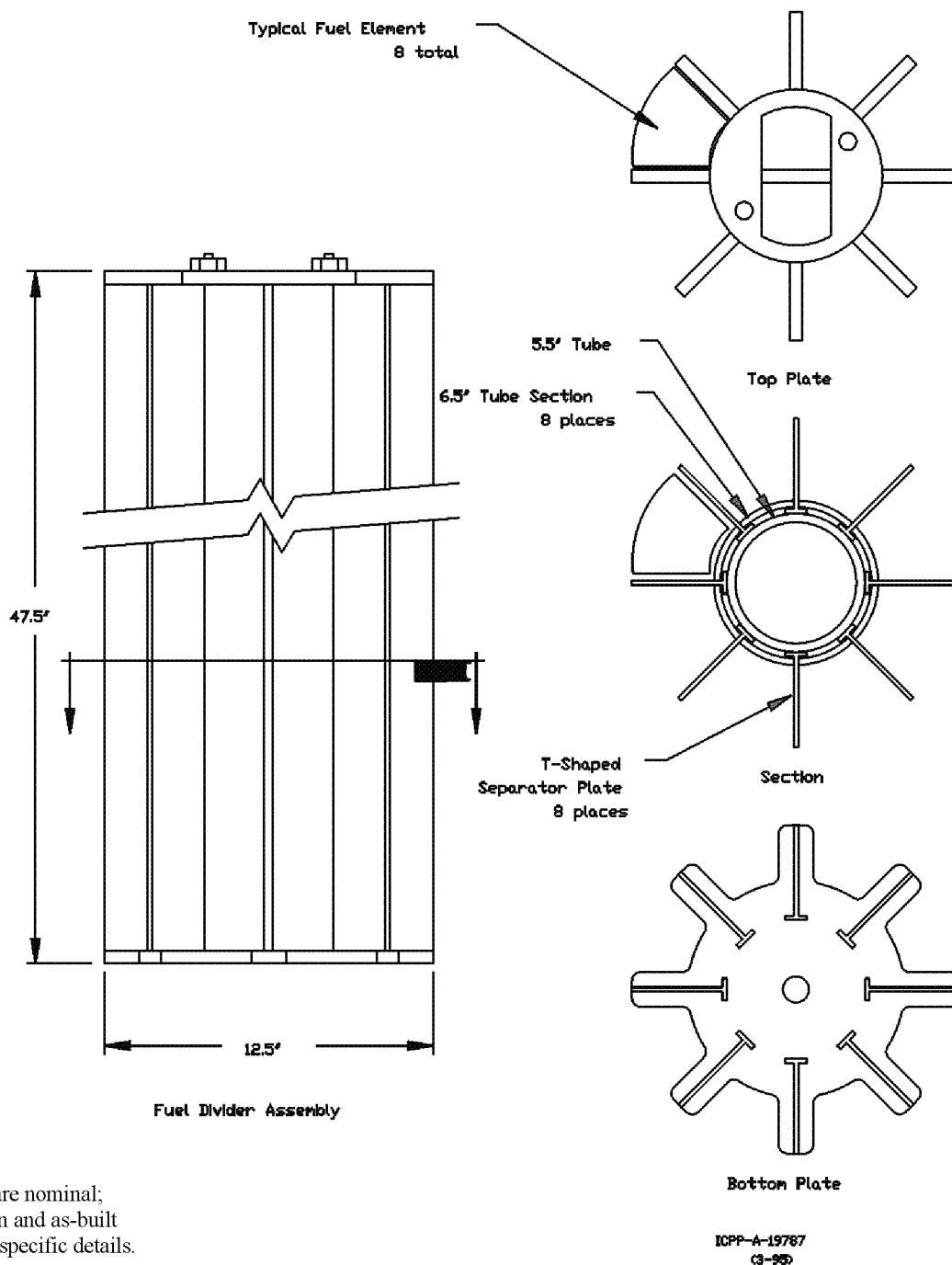
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Figure 2-20. ATR spent fuel element transfer cask divider.

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The authorized contents of the ATR cask, with the transfer cask divider inserted into the cask, are a maximum of 8 ATR fuel elements (nominal 1,100 g U-235 per element constructed as described in EG&G Drawing No. 405400). The maximum allowable cask total heat generation rate is 1.73×10^4 BTU/h (5.07 kW). The maximum allowable heat generation rate per element is 2.16×10^3 BTU/h (633.8 W) or 1/8 of the total maximum allowable heat generation rate for the cask. The maximum allowable cask curie content is 5.80×10^6 Ci. It should be noted that eight ATR spent fuel elements that meet the allowable heat generation rate are nominally expected to contain 1/4 of the allowable curie content.

2.4.3.2 Peach Bottom Cask. The Peach Bottom cask is used to transfer spent fuel elements between INTEC facilities. The cask is also placed into Unloading Pool No. 1 to allow removal or insertion of the cask insert. A brief description of the Peach Bottom cask is provided below. Additional cask details are contained in SAR-175.³¹

The Peach Bottom cask body is shown in Figure 2-21. The dimensions in Figure 2-21 and those cited in this section are nominal design values as contained in the original Battelle Memorial Institute (BMI) design Drawing No. N-9123-6-PB (INEEL Drawings 500204 through 5000212, 500219, 500224, 500226, 500238, and 500251). The cask body design is a steel-jacketed and lead-shielded cylinder with a maximum outer diameter of 42.62 in. and an overall length (including end plates and neglecting the lids) of 170.12 in. The maximum outer diameter is located over a symmetrically (axially) located, 110-in. section of the cask. The outer diameter at the cask ends is 40.62 in. for a 30.06-in. length at each end. The cask cavity inner diameter is 26 in. The end plates of the cask body have 12 threaded holes that provide the means to attach a cask lid and impact limiters to each end using the lid bolts. The end plates also have two tapped guide-pin holes (180 degrees apart) used for lid alignment.

2.4.3.3 Peach Bottom Cask Insert. A stainless-steel cask insert was used in naval fuel cask configuration to permit shipping of spent S3G-3 fuel from the NRF to the INTEC. The insert, shown in Figure 2-22, consists of a 25-in. outside diameter cylinder with a 1-in.-thick outer shell. The cylinder is divided into three compartments (ports) by three, radial, full-length webs, 1.25 in. thick. The insert bottom is a 2-in.-thick disk. Each port has guides shaped to provide support for the fuel elements, and has a lockable door. The bottom internal impact limiter is attached to the underside of the insert bottom disk.

The design requirements³² specified for the cask insert include providing: (1) a critically safe geometry of the fuel during normal and accident conditions, (2) adequate heat transfer, (3) temporary placement in the Peach Bottom cask cavity, and (4) an arrangement compatible with NRF and INTEC facilities for fuel loading and unloading. In addition to meeting these requirements, the insert design optimizes fuel shipping capacity, minimizes time and effort required to load and unload fuel, provides shielding consistent with the “as low as reasonably achievable” (ALARA) principle of minimizing personnel radiation exposure, minimizes permanent modifications to the Peach Bottom cask, and provides for easy removal of the insert if the cask is needed for other uses. Although the design does not utilize a nuclear poison, the stainless-steel insert material does have a neutron absorbing effect. The cask insert drawing is No. 1485J97.

After the cask is positioned in the unloading pool, the cask insert may be removed from or inserted into the cask. Once the insert is removed from the cask, it is either placed into an underwater location or is taken out of the unloading pool and placed into a storage box in the cask receiving area.

2.4.3.4 Cask Stand. A cask unloading stand supports the empty Peach Bottom cask during underwater operations in the FSA unloading pool (an empty cask may contain an insert or other hardware). A simplified view of this equipment is shown in Figure 2-23. The stand consists of a

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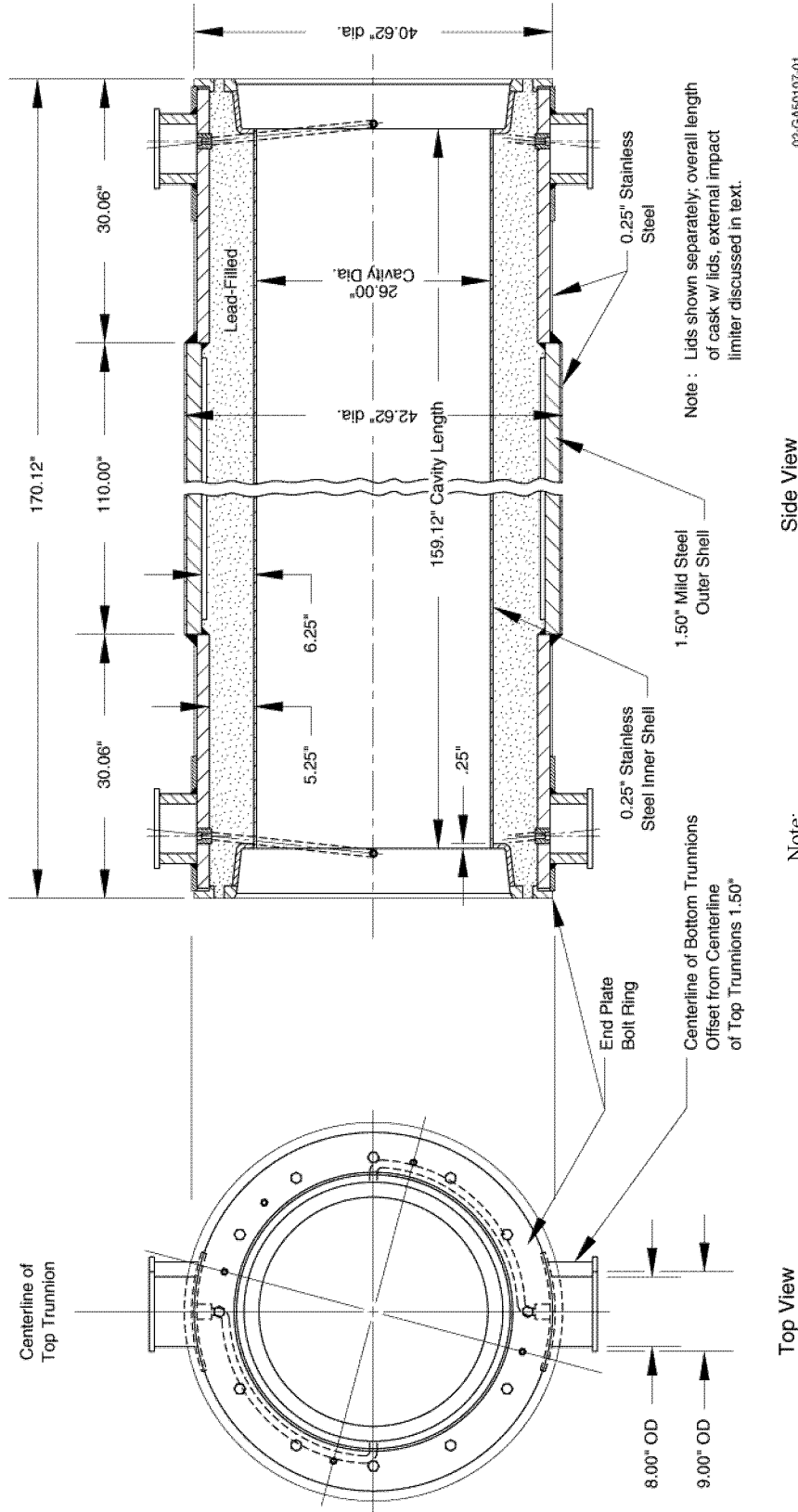
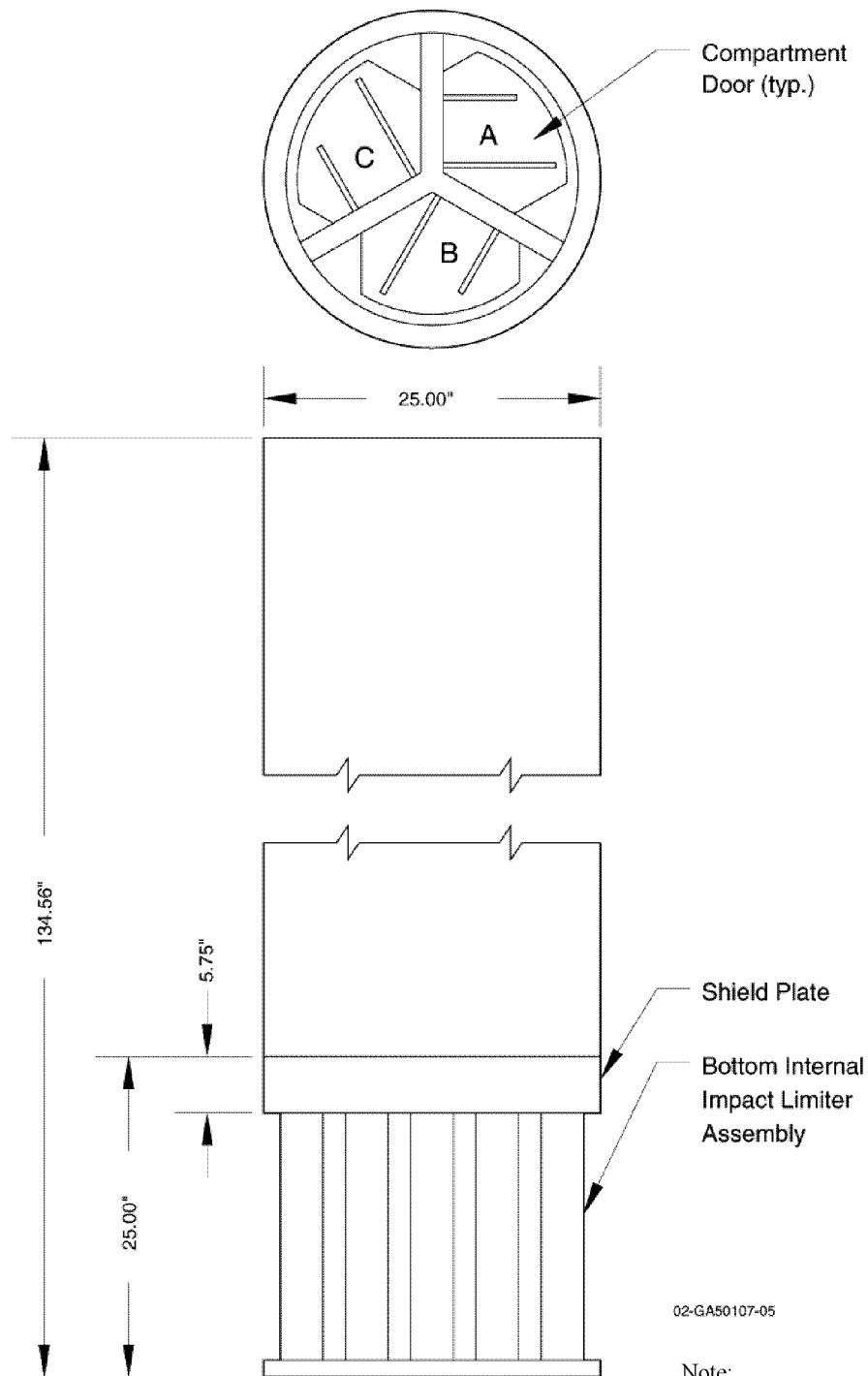


Figure 2-21. Peach Bottom cask body design.

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Note:
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drawings for specific details.

Figure 2-22. Peach Bottom cask insert for S3G-3 fuel.

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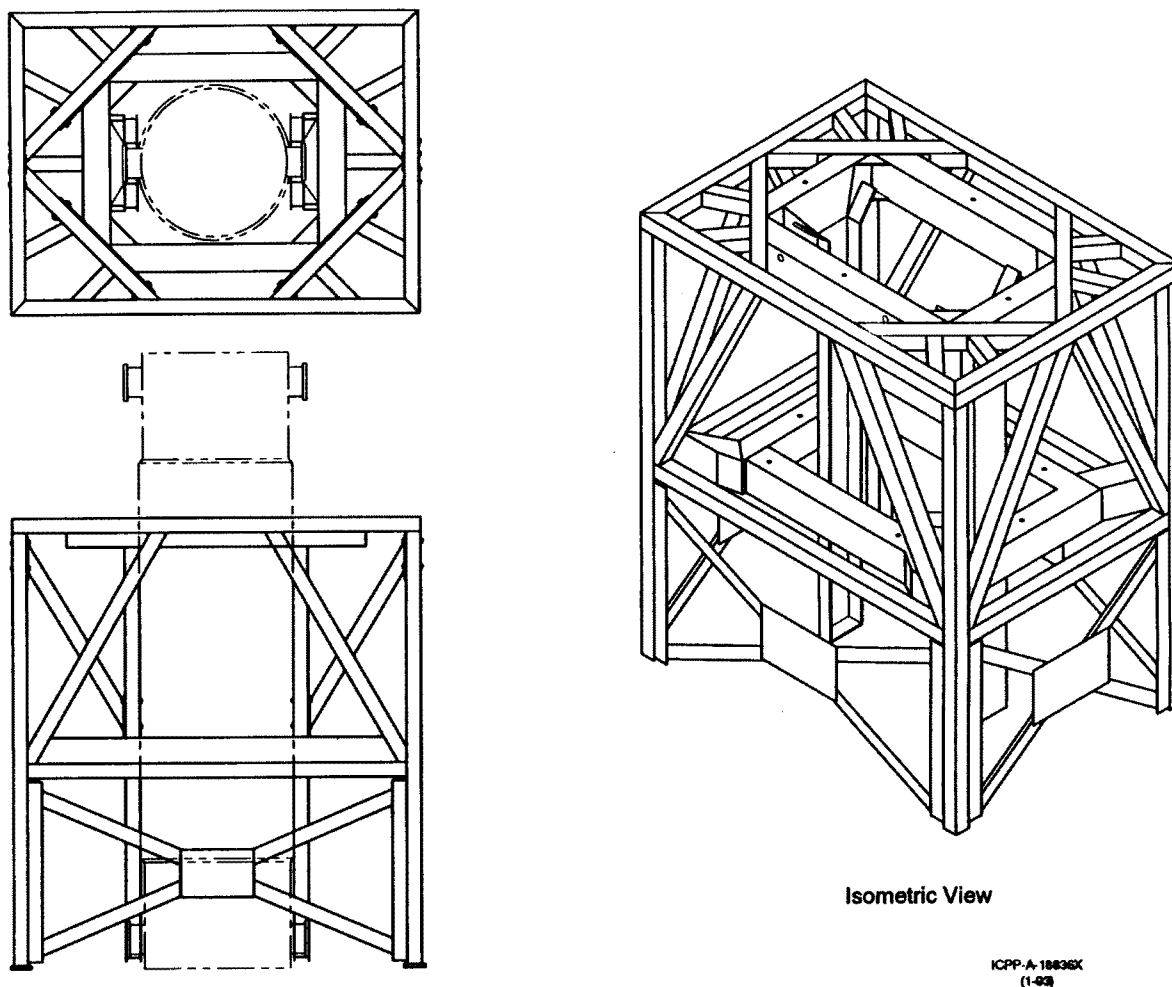


Figure 2-23. FSA cask unloading stand.

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framework capable of keeping the cask upright in the event of a FAST Facility seismic event. The cask, after preparations are completed, is lowered into the stand. The stand engages the cask lower trunnions and the cask body and holds the cask upright when the bottom surface of the cask is resting on the unloading pool floor. The cask upper lid bolts are removed, and then the lid is removed and set aside.

2.5 Process Description

The processes or operations conducted at the FSA include receiving fuel-loaded casks, unloading fuel from shipping casks, preparing fuel for storage, transferring fuel to storage, storing fuel under water, and retrieving fuel from storage. These operations and the associated major operating systems at the FSA are grouped as follows:

1. Truck and cask receiving
2. Fuel handling
3. Fuel cutting and preparation
4. Water treatment and management
5. Main control room (shift operating base)
6. HVAC.

Summary descriptions of these FSA operations and operating systems are presented in the following sections.

2.5.1 Truck and Cask Receiving

The truck receiving and cask receiving and decontamination areas provide a location for receiving cask shipments via truck, decontaminating the casks, and transporting the casks to the fuel unloading pools. The cask receiving and decontamination area is serviced by the cask handling crane, CRN-FR-903. The design capacity for the main hoist of the cask handling crane is 130 ton. The location of the truck receiving area and the cask receiving and decontamination area has been shown previously, in Figure 2-4.

After vehicles carrying incoming cask shipments arrive at INTEC, they are surveyed for radioactivity. To position a cask in CPP-666, one of the outer roll-up doors is opened, the vehicle enters the truck receiving area, and the door is closed. The truck receiving area functions as an airlock for the FSA. This airlock provides a method of temperature control, restricts dirt and other material from entering the pool area, and minimizes the release of any potential airborne contamination from the pool area to the environment. The truck receiving area was designed so that road dirt could be washed from the vehicle and shipping cask. The washwater and dirt were to be collected in floor sumps for disposal. Also, a vent system for removal of exhaust fumes from an idling truck is present in the area. However, this system is not typically used because vehicles are usually shut down as soon as they are properly positioned in the area.

Following receipt in the truck receiving area, an inner roll-up door is opened, the vehicle is driven into the cask receiving and decontamination area, and the inner door is closed. After the vehicle has been positioned in the cask receiving area and the cask tie-downs have been removed, the cask is removed from the vehicle with the cask handling crane (CRN-FR-903). The cask is surveyed by a radiological control technician (RCT) prior to removal of the cask from the vehicle. The cask is transferred to a staging area,

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surveyed, and, depending on the specific cask and its decontamination needs, moved to one of the decon rooms. In the decon room, the cask may be decontaminated and vented, or coolant may be drained from the cask. If treatment in the decon rooms is not necessary, casks are transferred directly to the unloading pools.

After any necessary filling (with water) or draining of the cask cavity, the cask is prepared for immersion into the unloading pool. Preparations may include loosening lid bolts, replacing existing bolts with remotely removable underwater cask lid bolts, installing lid lifting fixtures, etc. The cask is sprayed with DW as it is being lowered into the unloading pool, then set on the unloading pool floor, the lid is removed, and the fuel is removed from the cask. After unloading the fuel, the lid is replaced,^g and the cask is lifted from the fuel unloading pool, sprayed with DW, and drained over the pool.

The empty cask is decontaminated and cleaned as necessary, either in the decon room or at the decon pad area adjacent to the unloading pools. Decontamination includes washing with DW and hand-cleaning small contaminated spots on the cask that require further effort to remove. Waste water generated in the decon rooms flows through floor drains to the contaminated waste sump and is jetted to the basin DW neutralizer waste tank (VES-FT-134). After the empty cask is decontaminated and surveyed, it is either returned to the shipper or temporarily staged in the cask receiving area. If fuel is removed from storage and shipped from the FSA, the process involves essentially the reverse of these steps. Internal (to INTEC) transfers and fuel packaging activities consist of combinations of these steps.

The major systems in the truck receiving and cask receiving and decontamination areas are truck washdown, cask handling, cask venting and filling, cask decontamination, and cask coolant collection. The following sections summarize the functions of these systems.

2.5.1.1 Truck Washdown System. The truck washdown system includes the equipment to wash the vehicle and cask before they enter the cask receiving and decontamination area. As mentioned previously, experience has shown that operation of this system is generally not necessary.

Truck washdown utility stations are located on both sides of the truck receiving area. Flexible spray hoses are available to wash the cask and truck, and a floor sump receives the wash water run-off. Although the system is seldom used, water and waste from miscellaneous sources still occasionally collect in the sump. The sump has a dual function of settling heavy solids and decanting the water. The decanted water is intermittently pumped to the noncontaminated waste sump. The settled solids are periodically removed manually from the bottom of the sump and loaded into drums for shipment to the INEEL sanitary landfill. The solids are monitored for radioactivity prior to disposal and characterized for a hazardous waste determination.

2.5.1.2 Cask Handling System. The cask receiving and decontamination area includes the equipment needed to off-load (from vehicles) and move the casks between the cask receiving and decontamination area and the fuel unloading pools. Specific equipment for cask handling includes an overhead cask handling bridge crane (CRN-FR-903) and the rigging used in conjunction with the crane. Miscellaneous equipment is available to assist access to the top of the taller casks for direct-contact washdowns, surveys, maintenance, or other operations.

g. The cask lid may also be removed from the water and reinstalled on the open empty cask after the empty cask is removed from the water, if the particular operation involves staging the lid outside of the unloading pool.

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The cask handling crane (CRN-FR-903) is a Crane Manufacturer's Association of America (CMAA) 70, Class C (moderate) service crane with a main hoist design capacity of 130 ton and an auxiliary hoist design capacity of 25 ton. The crane bridge spans 71 ft 4 in., and extends over the cask receiving and decontamination area and the fuel unloading pools (see Figure 2-24). As shown in Figure 2-24, the crane hook does not extend over the fuel storage area; thus, cask transfers over the fuel storage pools are not possible. The construction of the building physically prevents the crane hook from reaching the fuel storage pool area. Limit switches that prevent overrun of the lift or traverse motions are not subject to operator override.

CRN-FR-903 has a box-girder-type bridge with a top-running trolley. Bridge and trolley positioning are aided by a microdrive capable of continuously smooth horizontal movements. The horizontal speed of the bridge and trolley ranges from 0 to 30 ft/min. At the rated load, the maximum main and auxiliary hook speeds are 7.5 and 15 ft/min, respectively. Both hoists are capable of providing continuously smooth movements in the vertical direction. The maximum hook height for the main hoist in the upper position is approximately 43 ft 10 in. above the operating floor, and the crane runway length is 203 ft.

The crane is radio-controlled with a pendant control as a backup. The radio-control system has a unique coded pulse train and system diagnostics to verify the pulse train. This coded pulse train eliminates the potential for signal receipt by other cranes in the area, which could result in inadvertent operation. The radio-control system for the cask handling crane is designed in accordance with Specification No. 70, CMAA,³³ with respect to motion control.

The cask handling crane is capable of retaining the maximum design load during a DBE. The bridge and trolley are provided with means for preventing them from leaving the runways with or without the design load during operation or earthquakes up to the DBE. The crane structures and support systems are designed to remain in a safe condition after the DBE even if they become inoperable.

The holding brakes for the main and auxiliary hoists are designed to 150% of the rated capacity and are capable of holding casks in an immobile position if a power loss occurs. The brakes can be mechanically released on demand if power is lost. The eddy current (electric control) brakes are automatically activated during loss of power. The eddy current brakes generate a current as the load is lowered, thus allowing controlled setdown of the load if the mechanical brakes fail or become inoperable. These features meet or exceed CMAA 70³³ and American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) B30.2 standards³⁴ for braking systems for both the main and auxiliary hoists. In addition, the main hoist, used for handling the heaviest casks, is designed with redundant holding brakes and gear trains and meets Nuclear Regulatory Guide (NUREG) 0554 standards³⁵ for single-failure-proof hoist braking systems for nuclear power plants.

Manual motion of the bridge or trolley may be accomplished by manually turning a special extension on the bridge drive or trolley drive gearboxes. This feature can be used to position a cask for lowering in the event of power loss.

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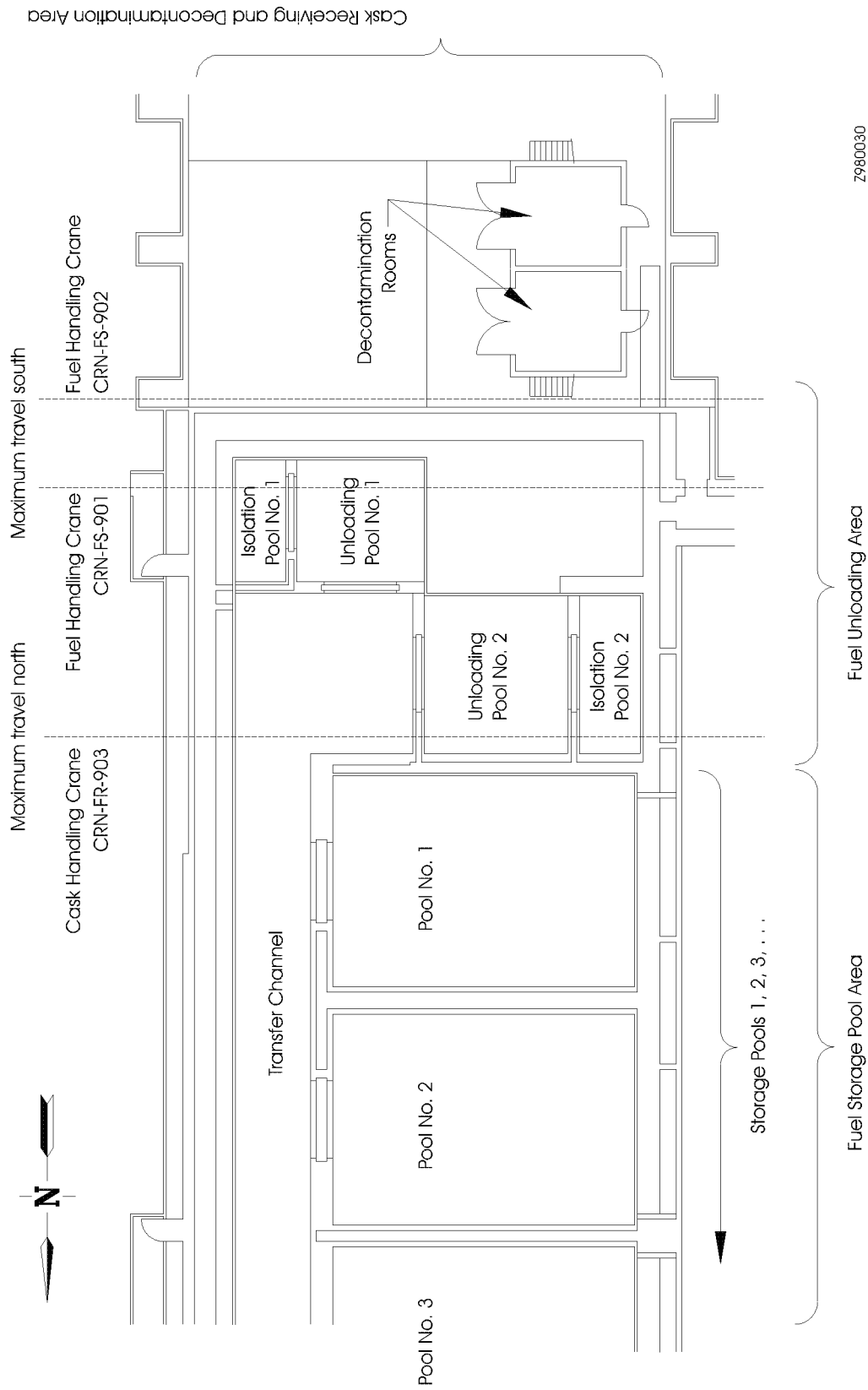


Figure 2-24. FSA pool area: plan view, south end.

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Appropriate rigging, including spreader beams, yokes, and slings, is used for operations conducted at the FSA to form an interface between the casks and the crane. Depending on the cask being handled, the rigging may consist of metal spreader beams or yokes or a system of slings. The required equipment varies with the cask and depends on the geometry and weight of the cask being handled. Permanent spreader beams and yokes, such as those shown in Figure 2-25, are available for those casks that are handled routinely. The following lifting devices are in use:

- CRNY-FR-907 - small cask spreader beam
- CRNY-FR-911 - small cask spreader beam
- CRNY-FR-950 - large cask yoke
- CRNY-FR-953 - large cask yoke.

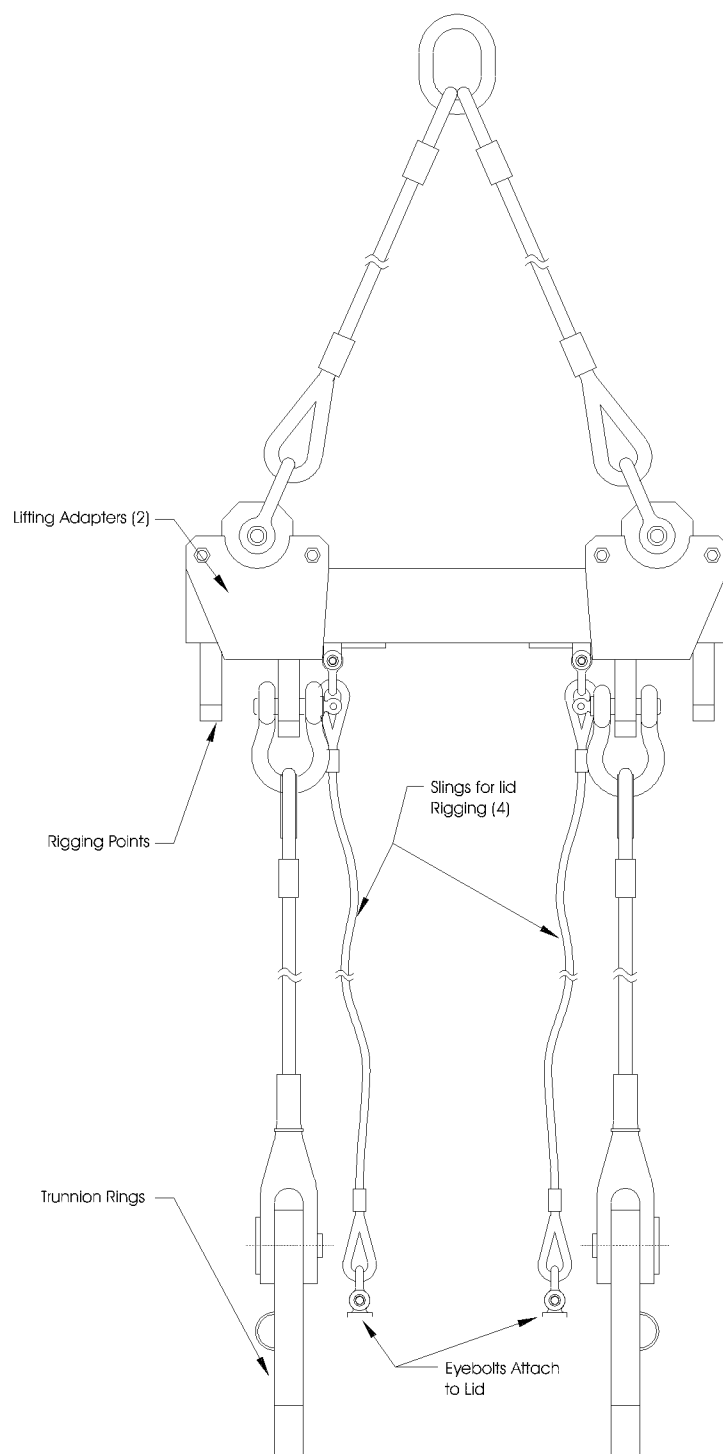
Other rigging systems can be used if they are compatible with the cask weight and geometry. These systems must comply with the hoisting and rigging program required by TSR-100 AC5.100.14, which includes design requirements for equipment and administrative practices such as preventive maintenance, load-testing, and pre-operational checks of equipment. The specific details of the program are derived from various sources, including national consensus codes on hoisting and rigging, and the applicable DOE standard, DOE-STD-1090-2001, "Hoisting and Rigging."³⁶ The hoisting and rigging program ensures safety factors in the fuel handling cranes, fuel handling tools, and other fuel handling crane hoisting and rigging equipment.

The small cask handling spreader beams are different sizes to accommodate specific casks. Spreader beams are designed to keep as much of the equipment as possible in a dry, clean environment to improve contamination control. Handling equipment is designed to provide the specific cask transfer elevation where needed.

A short spreader beam can be used to remove a cask from the truck, while a longer spreader beam, that, in conjunction with the cask provides sufficient stackup to place the cask on the unloading pool floor, is needed to submerge the cask. The longer design minimizes the distance a cask may be raised above the cask receiving area floor, thus minimizing the drop height in the event of a handling accident. The sufficient stackup also prevents submerging any part of the block, hook, or crane tackle when placing the cask on the bottom of the unloading pool. Submergence of these portions of the crane is avoided for contamination control.

The long spreader beam is also used in conjunction with the overhead crane to remove the cask lid when the cask is under water. Once a cask lid is removed, it may be temporarily stored within the unloading pool, or it can be placed in the area adjacent to the unloading pool. The same spreader beam may be used on several different casks.

Casks handled at the FSA must have a cask-specific safety analysis that envelopes the hazards at the FSA and authorizes the operation. The cask-specific safety analyses are contained within this facility SAR. Casks that have been analyzed and authorized are placed on the FSA approved cask list. The approved cask list is derived in Chapters 3 and 6 as a key element of the technical safety requirement (TSR) for cask handling. Requirements generated from these cask-specific safety analyses are enforced at the FSA, as applicable, and selection of cask lifting equipment is subject to restrictions developed in the analyses. The list of the casks that are approved for use in the FSA is provided in Chapter 6.

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Figure 2-25. Cask handling yoke, CRNY-FR-950.

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2.5.1.3 Cask Venting Systems. Many casks are received at the FSA with no coolant in the cask cavity, and the air in the cask cavity may be contaminated. This contaminated air could be released as a large bubble when the cask is submerged in the basin and the lid is removed. Therefore, cask venting systems are available for use when necessary and practicable. Affected casks are moved to the decon rooms and filled with water. As the cask cavity fills with water, the cask atmosphere vents via a flexible duct attached to or placed near the cask. The vented atmosphere is discharged to the decon room ventilation exhaust system, decon room sink drain, or floor drain. If cask design prevents attaching the duct directly to the casks, a different duct can be suspended directly over the cask to collect the vented substances.

The cask venting systems have no active components; the FSA exhaust system pressure differential provides the motive force to remove the cask atmosphere. The air vented from a cask is released to the decon room ventilation system that exhausts to the FSA HVAC system. The vented air passes through HEPA filters prior to being discharged to the environment through the facility stack.

2.5.1.4 Cask Decontamination System. Casks are cleaned and decontaminated as necessary to control contamination and to meet radiation control requirements. Manual wipedown of the casks is also performed as necessary. Low-pressure decontamination solutions, high-and low-pressure DW, and high-pressure steam are supplied to the decon rooms. The chemical decontamination portion of this system is inactive, and a water washdown system is the only system available for use. Waste water generated in the decon rooms flows through floor drains to the contaminated waste sump and is jetted to the basin DW neutralizer waste tank (VES-FT-134).

2.5.1.5 Cask Coolant Collection System. The cask coolant collection system is provided to collect coolants from casks. Operating experience has shown that the use of this system is generally not necessary. As designed, the cask coolant can be pumped to either the organic or inorganic collection tanks (VES-FT-136 or -137, respectively) by pumps located in each decon room.

The collection system features allow the inorganic coolant to be transferred back to a cask for reuse. If disposal is required, the coolant can be transferred to the basin DW neutralizer waste tank (VES-FT-134), the noncontaminated waste sump, or the basin water return sump. The original design allowed organic coolant to be transferred back to the cask or sent to the basin DW neutralizer waste tank (VES-FT-134) for disposal, but organic coolants are not currently used in the casks received at the FSA. The facility is still capable of handling organic coolants, and organic coolants are allowed if an evaluation of the consequences of their use is first completed and approved. (See Chapter 9 for more detailed discussions and illustrations of the liquid waste management systems.)

2.5.2 Fuel Handling

Fuel is received at the FSA from other locations within INTEC, such as CPP-603, from on-site transfers, such as NRF or TRA, or from off-site shipments. Fuel can also be removed from the FSA facility and transferred to other facilities. Fuel is shipped in accordance with shipping cask safety analysis and is handled in the configuration of fuel handling units (FHUs). FSA-specific cask analyses are included in this SAR. An FHU is a specific quantity and configuration of a particular fuel, as determined by a Criticality Safety Evaluation (CSE), that may be handled safely. An FHU may be a single piece of fuel or multiple fuel pieces. The fuel may be stored in its shipped configuration, or it may be packaged into new FHUs, depending on the fuel type. The first consideration of fuel storage operations is nuclear safety, but efficient use of fuel storage capacity is also a consideration. Packaging fuel pieces into new FHUs is sometimes done to make more efficient use of storage capacity and to permit more efficient fuel

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handling. Each FHU at the FSA has a unique identifying number that is used to track movement of the FHU throughout its storage life.

The following fuel handling sequence, shown graphically in Figure 2-26, generally describes the steps and responsibilities for FHU movements from cask receiving through transfer to the approved storage position:

1. A fuel receipt package containing procedures and the storage form for the specific fuel type is prepared. The complete package is reviewed by subject matter experts prior to acceptance of the shipment.
2. FSA personnel receive the shipping form from the shipper. This form contains, as a minimum, information on fuel type, identification number, and location of the FHU within the cask.
3. The movement of the vehicle into the truck receiving and cask receiving and decontamination areas is authorized, where the tie-down devices, weather covers, etc., are removed from the cask as indicated by the appropriate procedure. Each cask is surveyed for radioactive contamination.
4. Personnel unload the cask from the vehicle and move it to the staging area (including decontamination areas) as indicated by the procedure. The cask is placed in the unloading pool and the cask lid is removed. The FHU(s) are then removed from the cask.
5. Certified fuel handling operators verify the identification number before the FHU is moved to storage.
6. Fuel to be packaged is removed one piece at a time from the cask. Two certified fuel handling operators verify that a given piece has been correctly selected before it is loaded into the appropriate fuel storage device (such as bucket or basket). If the fuel does not require packaging, it is transferred directly to the storage location, as discussed in Step 7. Appropriate records are prepared.
7. FHUs are transferred to the designated storage position. The certified fuel handling operator deposits the FHU into the storage position, disengages the FHU, establishes any other required conditions, and closes the rack lid.
8. An inventory that matches fuel storage positions and fuel identification numbers is maintained by qualified FSA personnel.

Removing fuel from storage and shipping it from the FSA involves essentially the reverse of the steps described for the fuel storage process, except that a check is performed to ensure casks are empty of fuel prior to loading. Internal transfers and packaging of stored fuel consist of combinations of the above actions.

The functions of the equipment used to accomplish these fuel handling, transfer, and repackaging operations are described in the following sections.

2.5.2.1 Fuel Handling Cranes. The two fuel handling cranes (CRN-FS-901 and -902) are CMAA 70, light service, overhead traveling bridge cranes that provide access to the unloading and isolation pools, transfer channel, and fuel storage pools. Both cranes travel on a common runway and have 10-ton-capacity hoists. The maximum design operating speed for each hoist is 15 ft/min. The two

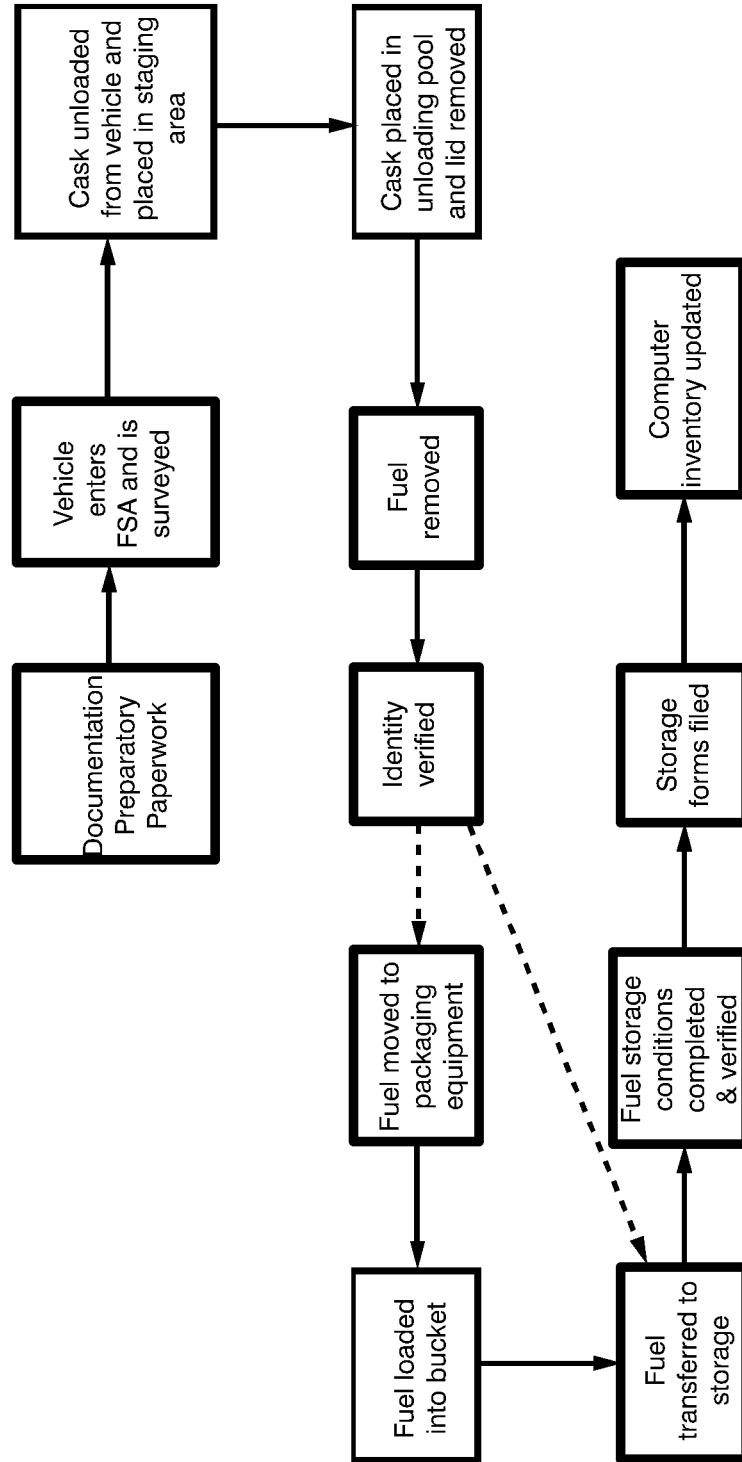
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Note: This diagram is only a generalization of fuel handling in the FAST facility and is not intended as a precise description.
Dashed lines show optional paths.

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Figure 2-26. FSA fuel handling sequence.

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bridges are box-girder types with top-running trolleys. Each bridge and trolley maximum design speed is 30 ft/min. The bridges can traverse the entire north-south distance of the rails, but the travel to the south is limited by interference of the crane operator platforms with the decon rooms. The extent of the south travel has been shown previously in Figure 2-24; travel limitations at the north end are shown in Figure 2-27. The maximum height for the hook for both cranes is approximately 26 ft above the operating floor (at zero grade). Limit switches that prevent overrun of the hoist or traverse motion are not subject to operator override.

The fuel handling cranes are used for underwater fuel handling operations, including transfers and packaging. The cranes are also designed for loading and unloading fuel from the transfer carts serving the fuel cutting pool or FDP cell. In addition, the cranes are used to handle the pool isolation gates and other pool equipment.

An operator platform with a movable extension is underhung from each crane bridge. The platforms provide a working area just over the water surface. This maximizes operator visibility and control of fuel handling operations.

The cranes were originally controlled by pendant control units; these rigid pendants have since been supplemented with radio controls. The fuel handling cranes operate by the same type of radio control system as that described for the cask handling crane. The control system is a digital type with a unique coded pulse train and system diagnostics to verify the pulse train. This eliminates the potential for signal receipt by other cranes in the area. The potential for a transmitter to communicate with a different receiver, resulting in inadvertent movement of the wrong crane, is eliminated with this system.

Each radio-controlled transmitter is engraved with the corresponding crane number. Both fuel handling cranes have the transmitter normally residing on the crane platform, since most operations with these cranes require the operator to be on the platform. However, the transmitters can also be used remotely, by an operator on the walkway around the pool area. Although the wrong transmitter could be selected, a variety of factors minimize the potential for this error. These factors include operator training, pre-operational checks of crane motion, engraved transmitter identification, and use of signal lights that indicate that the crane and transmitter are in communication.

The fuel handling cranes are capable of retaining the maximum load during a DBE, and the bridges and trolleys are prevented from leaving the tracks by physical restraints during operation or earthquakes up to the DBE. Consequently, the fuel handling cranes will not drop their load during a DBE. The cranes have redundant hoist holding brakes that are automatically activated on loss of power. The brakes can be mechanically released on demand if power is lost. The eddy current (electric control) brake is automatically activated during loss of power to the hoisting system. The eddy current brake generates a current as the load is lowered, thus allowing controlled setdown of the load if the mechanical brakes fail or become inoperable. Consequently, loss of power would not result in an uncontrolled lowering of the load. Holding brakes and the eddy current brakes meet or exceed CMAA 70³³ and ANSI/ASME B 30.2³⁴ standards.

Manual motion of the bridge or trolley may be accomplished by turning a special extension on the bridge drive or trolley drive gearboxes. This feature can be used to position the load for lowering in the event of a power loss.

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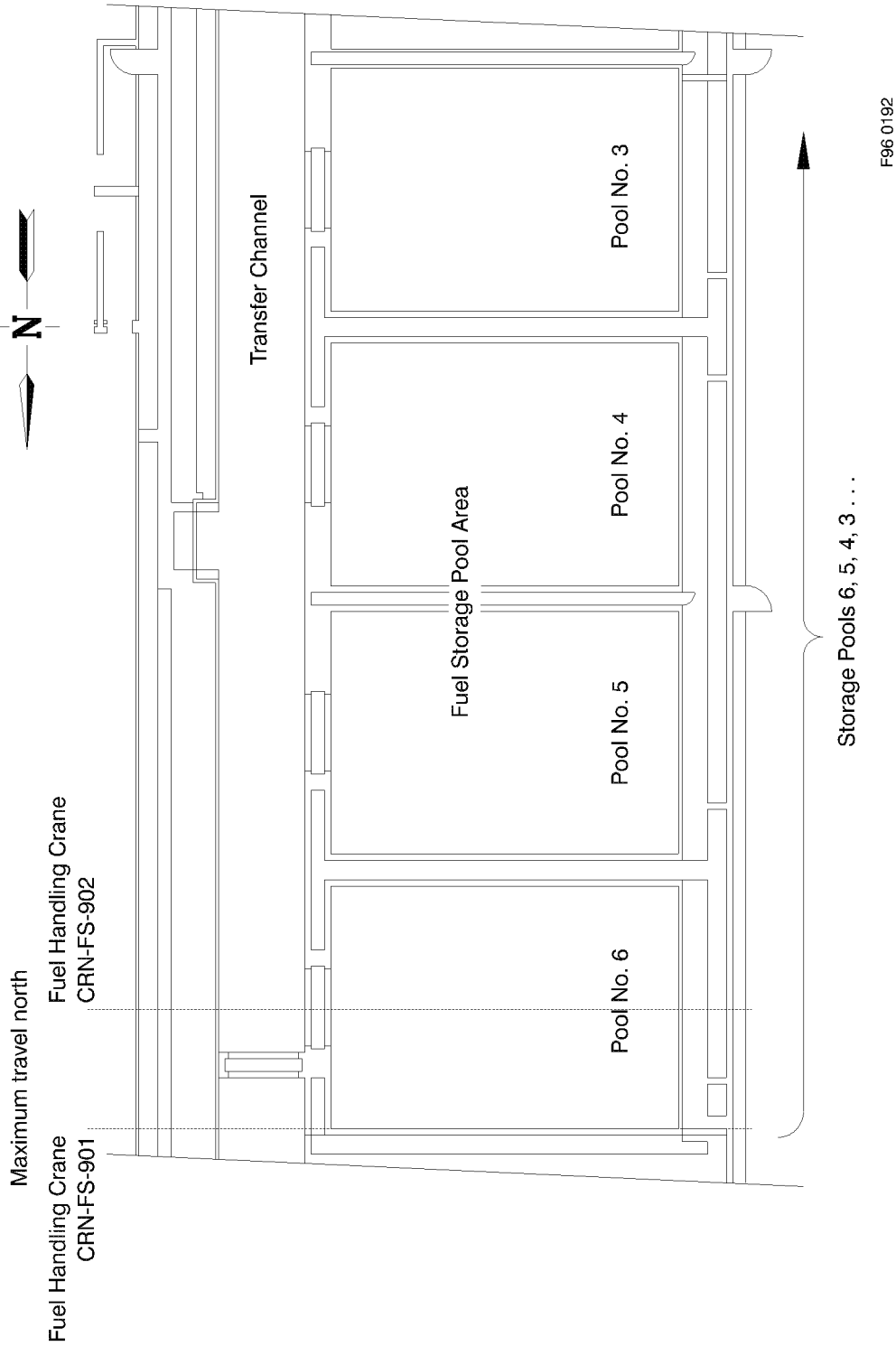


Figure 2-27. FSA pool area: plan view, north end.

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2.5.2.2 Fuel Handling Tools. Both manual and crane-assisted tools are used for handling fuel in the FSA. Special tools are used or built as necessary for the specific fuel being handled. Extended-reach tools are used to assist the operator during fuel handling operations and can also be used to handle lighter fuel.

Extended reach tools and hooks are used in conjunction with the crane. Since the depth of every pool exceeds the available overhead height of the two fuel handling cranes, raising fuel above the water surface can be prevented by design when using a fuel handling tool attached to the crane hook (known as crane-assist mode). Selection of the fuel handling tool length for the crane-assist mode is a feature that prevents fuel from being raised too close to the water surface, thereby minimizing direct radiation exposures to immediately affected facility workers. In addition, the tool length also ensures that the crane tackle block and hook are not submerged, thereby minimizing the potential for contamination of crane components.

2.5.2.3 Transfer Carts. The underwater transfer cart system is illustrated in Figure 2-9. Two carts (now inactive) are available to transport fuel under the concrete barriers isolating the fuel cutting pool area from the fuel storage area, and two carts are installed to transfer fuel to the inactive FDPA. If fuel were to be taken to the fuel cutting pool area or FDPA, a fuel handling crane would be used to transport the fuel from the unloading pool or storage pool along the transfer channel to the appropriate transfer cart. The transfer carts are moved by a cable system along a track.

The carts consist of a top-loading, fuel-carrying tube mounted on a wheeled cart. The carts are rail-supported and are driven in either direction by a continuous-loop cable powered by a stationary drive motor located above the pool water level. There are two carts on parallel tracks in the transfer channel leading to the cutting pool, and two other carts allowing movement to the FDPA.

To preclude interaction between transferred FHUs, physical barriers around the carts ensure 8-in. spacing between an FHU inside the cart and an FHU passing by a cart. Double batching is prevented by using administrative controls and inserts within the fuel tube.

Since the cutting pool and FDPA are inactive, these systems are not used. In addition, this SAR does not authorize the use of the carts or the presence of fuel in the carts.

2.5.2.4 Fuel Packaging Equipment. Fuel packaging equipment, such as insert support stands, basket/bucket loading stations, etc., are used for packaging fuel pieces into approved FHUs. These are described and illustrated in Section 4.4.5.

2.5.2.5 Fuel Canning. The fuel canning system was originally designed to repackage fuel into cans. The canning equipment consists of two stainless-steel support frames with a 6-in. and a 16-in. hole and four fuel canisters. The stainless-steel canisters are fabricated from 16-in.-diameter pipe and have metal bolt-on lids. One stainless-steel canister is 9 ft 6-1/4 in. tall and weighs 380 lb, while the other canister is only 5 ft 1/4 in. tall and weighs 240 lb. The aluminum canisters are fabricated from 6-in.-diameter pipe and also have metal bolt-on lids. One canister is 9 ft tall and weighs 36 lb, while another is 4 ft 6 in. tall and weighs 22 lb.

The canisters are vented to prevent pressurization. If particulate contamination escapes from the canister, it is contained by the pool water and removed by the water treatment system. Gaseous activity is removed by the basin area HVAC system and discharged out the stack.

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Fuel canning was designed to take place in the isolation pools adjoining each of the two fuel unloading pools but can be done in other appropriate locations. These pools can be isolated from the rest of the storage pools and the transfer channel by gate installation, and the pools can also be purged by water. If a fuel requires canning, it is moved by a fuel handling crane into a submerged canister, and the canister is bolted shut by extended-reach tools. After the canning operation, the fuel is transferred to storage.

2.5.2.6 Fuel Storage Racks. Fuel storage racks are used in each of the six fuel storage pools to ensure critically safe storage of fuel. The racks are described in Section 4.4.2.

2.5.2.7 Pool Isolation Gates. There are 7 pool isolation gates of 3 different designs that can fit into 11 different gate openings. One design is for the deep gate openings of Pools 1 and 2, Unloading Pool 2, and Isolation Pool 2; another design is for the shallow gate openings of Pools 3, 4, 5, and 6, Unloading Pool 1, and Isolation Pool 1; and the third design is for the cutting pool gate opening. A typical gate, with applicable dimensions, is shown in Figure 2-28. The gates range in size from 19 ft 6 in. to 23 ft 3 in. tall and weigh between 4 and 6-1/2 ton. The gates taper from the bottom, where they are from 6 ft 1 in. to 8 ft 5 in. wide, to the top where they vary from 11 ft 11 in. to 9 ft 7 in. wide. All gates are 11 in. thick, with 1-in. bearing bars on each side, resulting in a total thickness of 13 in. The gates are installed or removed using either of the fuel handling cranes (CRN-FS-901 or -902) or the cask handling crane (CRN-FR-903). The bottom of the pool gate opening is at the -20-ft elevation for the shallow pools, which is 11 ft above the pool and transfer channel floors. For Pools 1 and 2, the bottom of the gate opening is at the -23-ft 9-in. elevation, which is 7 ft 3 in. above the transfer channel floor and 17 ft 3 in. above the deep pool floors.

The deep gates for Pools 1 and 2 and Unloading and Isolation Pool 2 weigh 6-1/2 ton. The shallow gates for Pools 3, 4, 5, and 6 and Unloading and Isolation Pool 1 weigh 5-1/3 ton. The cutting pool gate weighs 4 ton.

Each gate contains a lifting lug on top. The gates are fabricated of stainless steel and are equipped with inflatable pneumatic seal assemblies installed around the gate seating surfaces. The pool gates (except for the cutting pool gate) have been modified, by adding two I-beams to the gate face across the width. These I-beams are intended to prevent an inadvertently released gate from dropping into the fuel storage pools or onto the fuel storage racks or fuel in the unloading or isolation pools. Brackets outside each pool have been installed for storage of the gates in the transfer channel when the gates are not in use. The pool gates may or may not reside in the facility at any one time.

The gates are sealed by inflatable pneumatic seals. After the gates are positioned, air is supplied to the seal from an accumulator that is pressurized by the plant instrument air system. The seals inflate and form a barrier that prevents water flow from one side of a gate to the other. Instrumentation is installed to monitor seal air pressure.

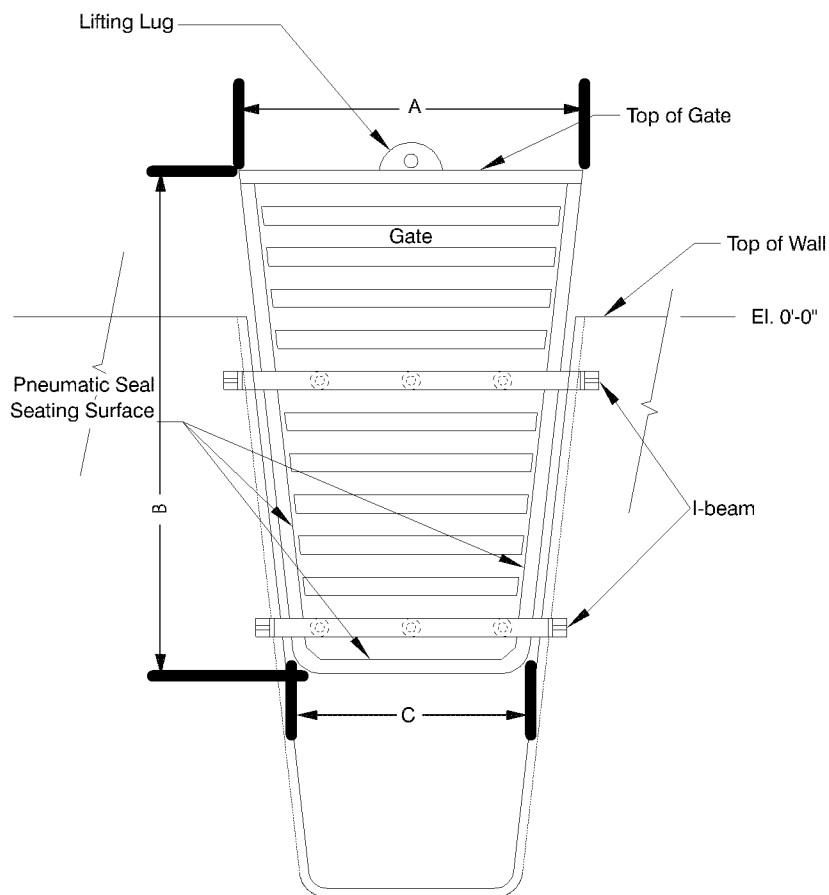
2.5.3 Fuel Cutting and Preparation

The fuel cutting and preparation systems consist of the fuel transfer carts and the cutting pool crane (CRN-FS-904). For more information on the fuel transfer cart system, see Sections 2.4.1.5 and 2.5.2.3. The cutting pool crane provides a fuel and equipment transport system within the fuel cutting pool area.

Crane CRN-FS-904 is a CMAA 70 normal service crane and has a 5-ton-capacity hoist with a design operating speed of 0-to-15 ft/min. The bridge is a single-girder type, with an underhung monorail trolley. The maximum operating speed of the bridge and trolley is 30 ft/min. The maximum hook height is 15 ft above the operating floor (above zero grade). The bridge span is 22 ft 4 in., and the runway is approximately 50 ft long.

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Dimensions Gates	A	B	C
Shallow (4 gates)	11 ft 11 in.	19 ft 6 in.	8 ft 5 in.
Deep (2 gates)	11 ft 11 in.	23 ft 3 in.	7 ft 9 in.
Cutting (1 gate)	9 ft 7 in.	19 ft 6 in.	6 ft 1 in.

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Figure 2-28. Pool isolation gate design.

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The cutting pool crane is designed so that the design load will be retained during seismic events up to the DBE. Two hoist holding brakes are automatically activated during a failure or malfunction of the hoisting system, ensuring that the load will be held without dropping. The brakes can be mechanically released on demand if power is lost. The bridge and trolley are prevented from leaving the runway under normal conditions and earthquakes up to the DBE. The braking performance of the hoist conforms to the requirements of CMAA 70³³ and ANSI/ASME Standard B30.2.³⁴

Manual motion of the bridge or trolley may be accomplished by manually turning a special extension on the bridge drive or trolley drive gearboxes. This feature can be used to position a load for lowering in the event of a power loss.

The fuel cutting pool area is inactive and has never been used.

2.5.4 Water Treatment and Management

The following FSA water treatment and management systems are described in this section:

- Basin makeup water treatment and distribution
- Basin recirculating water treatment
- Basin water management
- Basin liner leak detection.

Some systems are inactive and are not described in detail; they are listed, however, since the systems still exist and can be used upon proper evaluation and approval.

Control of water quality is important to minimize corrosion rates of fuel and storage equipment. At the FSA, the principal parameters governing corrosivity are the conductivity and the chloride ion content of the water. (Chloride ion is a major contributor to conductivity). The water treatment and management system functions by providing low chloride/low conductivity water and treating the recirculating pool water. Controlling the water quality also minimizes the radionuclide content of the water and consequently supports the policy of keeping radiation exposure as low as reasonably achievable (ALARA) at the FSA. Pool water sampling and monitoring provide awareness of the water composition (primarily the chloride ion content), conductivity, and radionuclide content.

Conductivity provides a measure of the ion content of the water arising from dissolved solids and some gases. The makeup water system has the capability to provide water of conductivity less than 0.1 $\mu\text{S}/\text{cm}$. Dissolved solids are introduced into the water by normal operations such as cask submergence and fuel handling. The effects of normal operation are cumulative but are controlled by operation of the basin water recirculating system.

Chloride ion content is of special concern because it can result in severe pitting of aluminum alloys. It also promotes intergranular stress corrosion cracking of stainless steel. Chloride ion present in the pool water (such as that which might be inadvertently added when fuel is moved into the FSA) is removed by the recirculating water cleanup system.

Water treatment and management parameters can be adjusted, or the system can be shut off, as needed, to support operations, maintenance, or other considerations. This flexibility is possible, since system operation is not required for safety purposes, as shown by the hazard evaluation in Chapter 3.

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2.5.4.1 Basin Makeup Water Treatment and Distribution. The FSA basin makeup water treatment system provides DW to the FSA. This water replaces water that evaporates from the storage pools, and it is also distributed to other locations throughout CPP-666. The original in-facility deionized makeup water treatment system is inactive (skid-mounted package in Room 164 abandoned in place), and DW for the FSA is supplied from the INTEC utility building (CPP-606). A continuous deionization (CDI) polishing unit (polisher) located in CPP-666 may be used to further purify the water received from CPP-606. The effluent discharged from the CDI is now diverted to the process equipment waste (PEW) system. The use of the CDI system has been discontinued due to waste generation concerns.

A schematic diagram of the basin makeup water treatment and distribution system is shown in Figure 2-29. DW is sent from CPP-606 to the polisher or a 15,000-gal storage tank (VES-FT-126) located in the nonradioactive section of the water treatment area. The tank contains level indicators and alarms and provides reserve capacity to meet the requirements of basin water makeup and the DW distribution system.

The water supplied to the CDI unit is filtered and sterilized to reduce the growth of microorganisms within the polisher. The CDI unit uses a continuous deionization process to remove ions in the water using a combination of membranes that are selectively permeable to anions or cations, but not permeable to water. An electric charge is applied across the membranes and resin for continuous regeneration of the unit. This feature eliminates the need for the typical chemical regeneration process step associated with ion exchange systems.

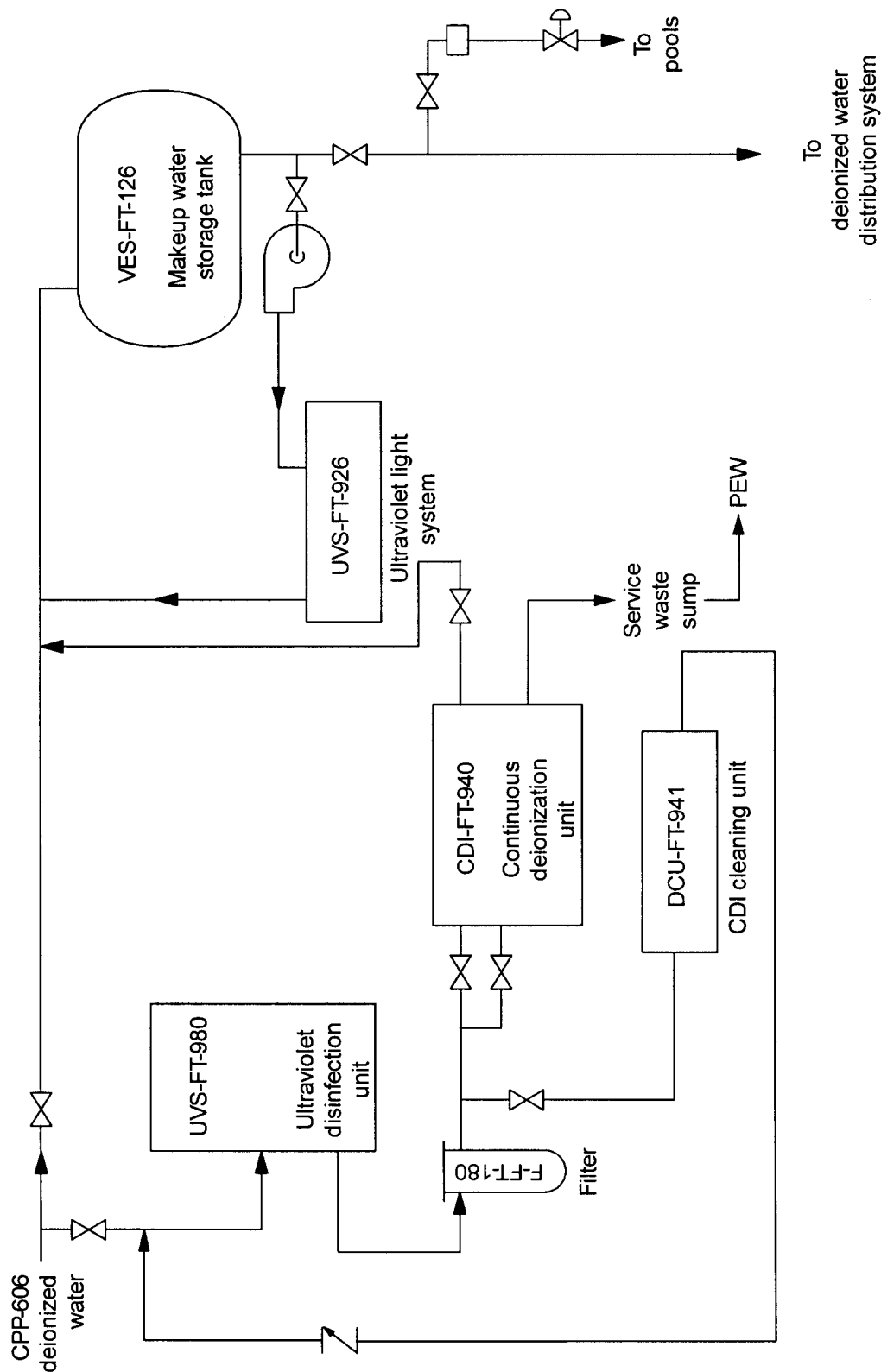
The CPP-666 DW distribution system consists of two distribution pumps, a 170-gal distribution tank (VES-FT-169), and associated distribution piping. This system provides DW water throughout CPP-666 for decontamination and other needs.

2.5.4.2 Basin Recirculating Water Treatment. The recirculating water treatment system maintains the high water quality in the fuel storage pools. The system provides some pH control, minimizes turbidity and conductivity, removes radionuclides, kills microorganisms, and removes heat. It has a design capacity of 1,100 gpm, although the actual flow may be less, depending on the pressure differential across the filters and other factors. The system has been evaluated and shown to have sufficient water treatment capacity to manage the effects of storing up to 10,000 FHUs in 5,000 ports in the FSA.³⁷

The recirculating system equipment includes two parallel filters, two parallel deionizer trains, one water chiller package (inactive), one propylene glycol cooling system, one ultraviolet sterilization system (inactive), and the equipment associated with filter backwashing and resin loadout (see Figure 2-30). The chemical regeneration system for resin (deionizers) regeneration is inactive and has never been used and would require an assessment of its effects on the system before it could be used. The resins are now replaced when depleted, rather than regenerated, as anticipated in the original design. In addition, the water-chiller package has been mothballed due to concerns of inadvertently releasing ozone-depleting substances (ODSs) and the 2.4 kV power source has been removed.

Water is supplied to the recirculating water treatment system by the basin water return sump pumps described in Section 2.5.4.3 (Pumps P-FT-211 and -212, or -213, which is inactive). The flow divides to enter two parallel filters (F-FT-806-A and -B). These filters remove suspended solids to prevent overloading the deionizer trains with excessive suspended solids and to control water clarity. The filters are backwashed when the pressure drop across them reaches a pre-established limit. The backwash is flushed to the filter backwash decant vessel (VES-FT-133). Originally, the decanted backwash water was to be transferred from the decant vessel to the low-level liquid radioactive waste system, and the solids

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Figure 2-29. Basin makeup water and distribution system.

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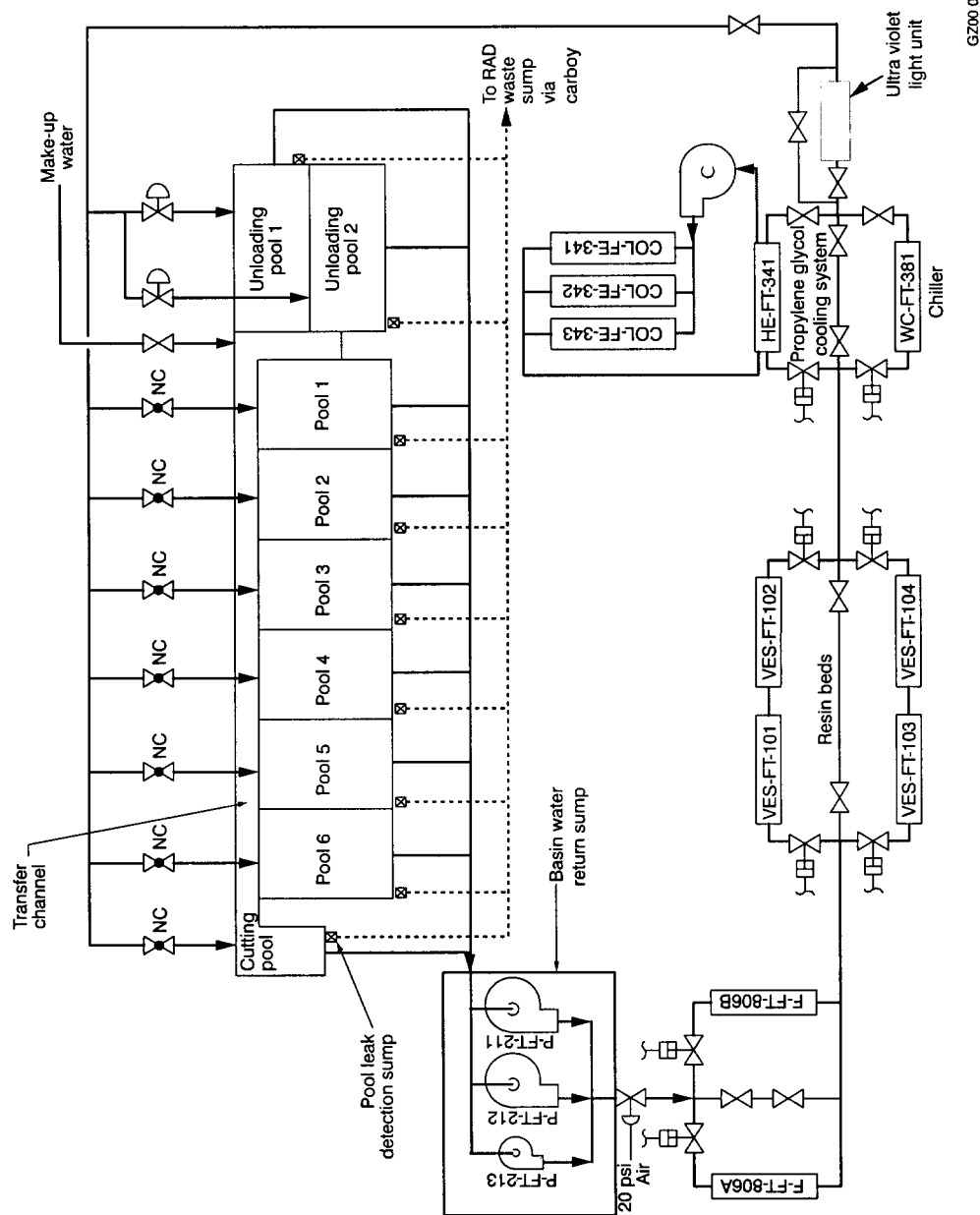


Figure 2-30. Basin recirculating water treatment system.

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remaining in the decant vessel were to be removed periodically. However, the backwash flush water now is passed through the filter backwash decant vessel to the contaminated waste sump. The liquid fraction decants in the sump and is transferred to the PEW system. The filter backwash solids are accumulating in VES-FT-134. When sufficient solids accumulate, they can be removed and disposed of as appropriate, based on the measured radionuclide content and a hazardous waste determination.^h Some solids may still be present in the filter backwash decant vessel.

After filtration, the basin water enters a common header and flows to one of the two parallel deionizer trains (VES-FT-101 and -102 or VES-FT-103 and -104). The deionizer trains consist of a cation exchange bed containing a strong acid cation exchange resin and a mixed resin bed. Trains consisting of a cation bed and anion bed may also be used. These ion exchange beds remove dissolved solids, including chlorides, heavy metals, and radionuclides from the basin water. Some pH adjustment can be obtained by bypassing one or the other of the beds. When significant breakthrough of dissolved solids occurs, as indicated by increased Co-60 levels, the resin is removed remotely and replaced rather than regenerated. The resin is flushed from the beds with DW, and depending on the resin type, is transferred to the appropriate anion or cation spent resin tank. The resin is stored until disposal (see Chapter 9).

After deionization, the basin water enters a common header and divides to enter one of two heat removal systems (WC-FT-381 or HE-FT-341). Water temperature control minimizes the growth of microorganisms in the pools and also reduces corrosion rates. These heat removal systems remove the decay heat generated by the stored fuel and maintain the water temperature below 85°F. Originally, two similar rotary screw chillers were installed. One of the original chillers, WC-FT-382, has been removed. The other original water chiller, WC-FT-381, has been mothballed due to concerns of inadvertently releasing ozone-depleting substances (ODSs) and the 2.4 kV power source has been removed. Sufficient cooling is attained with the replacement propylene glycol cooling system. Water Chiller WC-FT-381 had a removal capacity of 2.76×10^6 BTU/h at a flow rate of 550 gpm. The new replacement cooling system has a capacity of 1.98×10^6 BTU/h at a flow rate of 800 gpm. The capacity of the new unit is sufficient to remove the predicted decay heat generated for the next several years. Air-cooled condensers are available on the roof to dispose of the heat.

After the heat removal packages, the basin water is routed via a common header to the ultraviolet sterilization system and from there back to the fuel unloading or storage pools. The ultraviolet sterilization system destroys biological organisms in the water circulating through the system, thereby reducing the microorganisms in the water, principally algae and bacteria. Control of microorganisms in the recirculating pool water improves water clarity. The ultraviolet system has been out of service for several years due to leaks in the system, but could be operated if needed.

Common headers and bypasses are provided between major water treatment system components to allow operating flexibility. Under normal conditions, use of the full 1,100-gpm capacity of the recirculating water treatment system is not necessary. Excess capacity, the redundant nature of the system, and the large volume of water allows some system components to be shut down temporarily for maintenance, repair, or energy conservation.

Pressure, liquid level, and flow monitors are positioned throughout the system. Conductivity and temperature are monitored as part of the water treatment process. The computer-based FAST Distributed Control System (FDCS) is used to control and monitor recirculation water treatment system operation. Alarms and messages warn the operator of improperly functioning equipment. Water treatment equipment

h. As discussed in Chapter 3, handling of filter solids is not authorized by this DSA.

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that collects radioactive material is contained within concrete-shielded areas (cells, rooms, vaults) for personnel protection. This equipment includes the filtration, deionization, and spent resin loadout systems, and the filter solids handling system.

2.5.4.3 Basin Water Management. Basin water is managed by operating the recirculating water treatment system to assure adequate water flows through the fuel storage pools. The recirculating water treatment system equipment includes distribution piping, overflow weirs and skimmers, sump pumps, isolation gates, and a vacuum cleaning system.

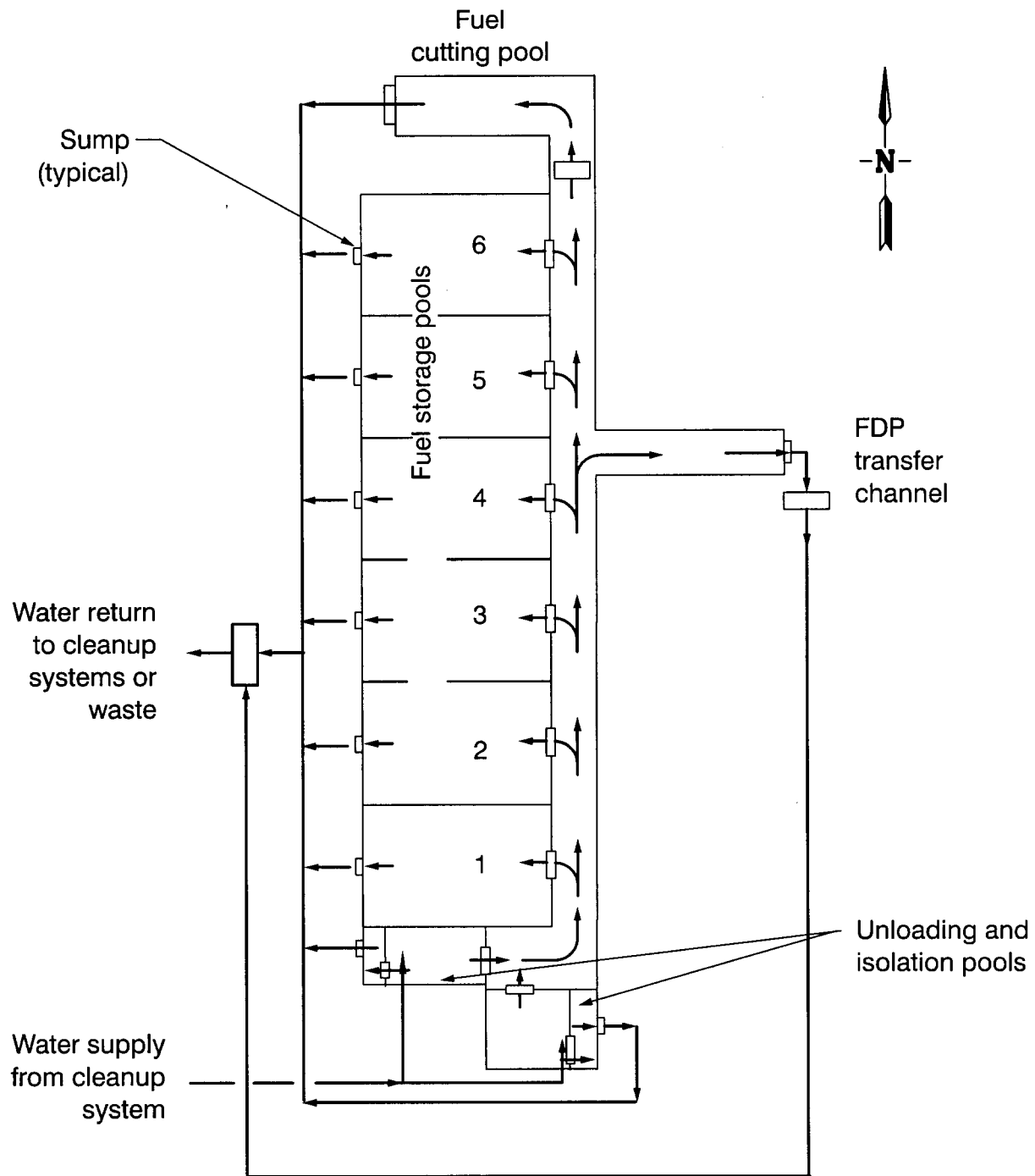
The basin water distribution system flowpaths are shown schematically in Figure 2-31. The system is designed to distribute a maximum of 1,100 gpm to the basin, as described in Section 2.5.4.2. During normal operation, approximately 550 gpm of water is evenly distributed to the two unloading pools from the recirculating water treatment system. From the unloading pools, the water flows to and through isolation pool gate openings to the entire underwater area. Most of the flow goes to the six storage pools with the balance being directed to the two isolation pools, the cutting pool, and the FDPA transfer channel. Water is circulated from areas with less potential for contamination to areas with a higher potential.

The basin water recirculation system piping is located in the pool area. South of Unloading Pool 1, the piping is located in an east-west oriented trench. In some places, the elevation of this piping section changes to slightly above the normal pool water surface (–1 ft), penetrates the wall between the trench and the south side of Unloading Pool 1. After the penetration, the pipe runs to near the bottom of the pool where the return water is injected. The return line for the piping is located on the west side of the pool area. The line along the south side of Unloading Pool 1 is potentially vulnerable to damage from the drop of a heavy object, since cask handling activities are conducted in the area. Casks and heavy objects are routinely transferred over the area to allow them to be placed in or removed from the unloading pool. The return line on the west side of the pool area is less vulnerable, since heavy objects are not carried over the area.

The recirculation system piping, 6-in.-diameter pipe, runs from the basin water treatment system to Unloading Pool 1. The trench containing the pipe is 4 ft wide and 6 ft deep, and the bottom of the pipe is approximately 56 in. below the surface of the floor, or approximately 44 in. below the normal basin water level. The trench is covered with deck plate, ¼ in. thick, to allow passage over the trench by personnel and equipment. A diagram of the area showing the piping location is shown in Figure 2-32. There is no vacuum breaker device on the line.

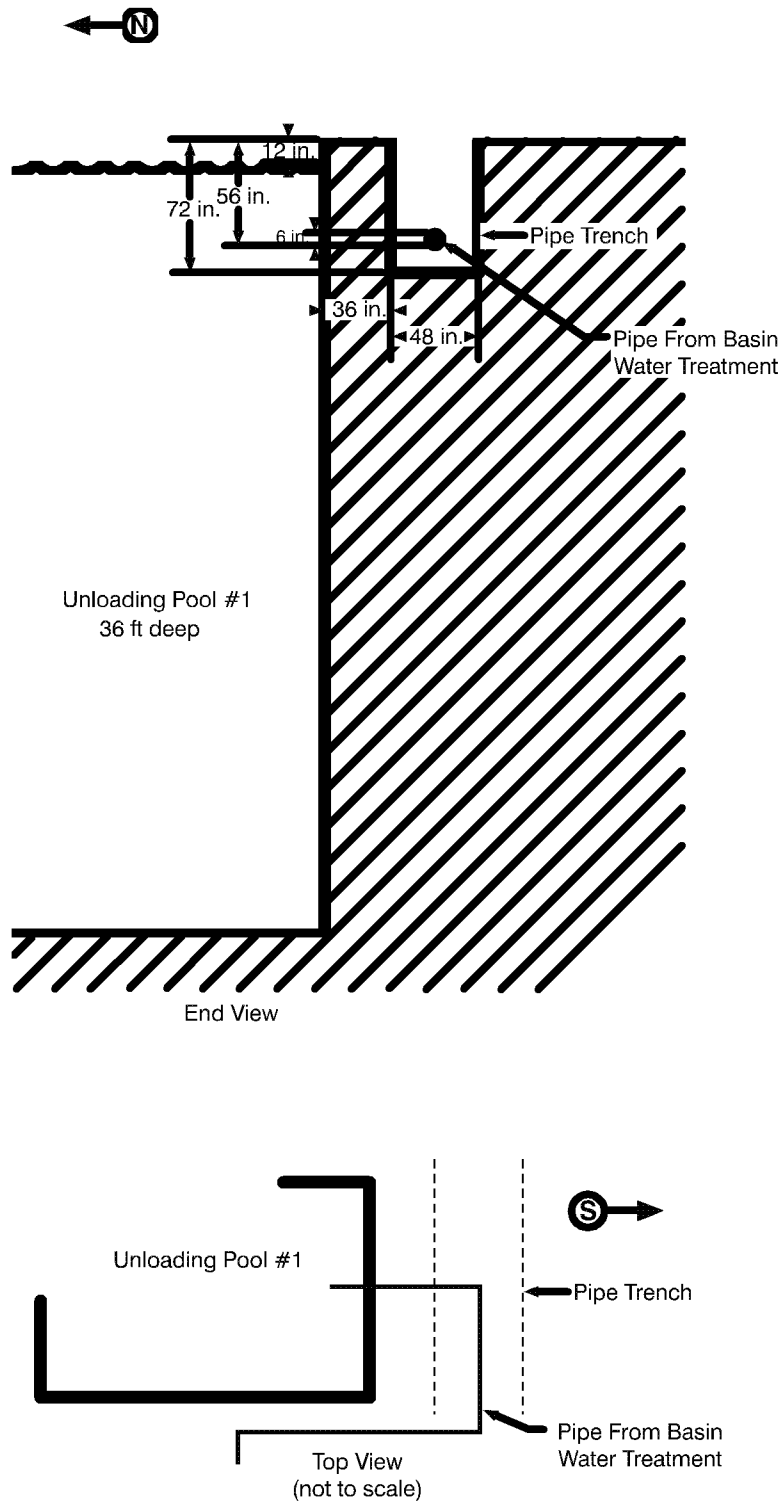
The transfer channel has a 550-gpm distribution system to supply water flow to the storage pools, cutting pool, and FDPA transfer channel. In addition, five of the storage pools have individual supply systems sized for 550 gpm, and one storage pool (No. 6) has an 1,100-gpm supply system. The cutting pool has a 125-gpm supply system. These supply systems are used only when a pool is isolated. The supply manifold for each of the six storage pools and the fuel cutting pool are located on the same side of the pool as the isolation gate. Return systems are located on the opposite side of the pools. The FDPA transfer channel does not have an independent water supply system.

Overflow weirs and skimmers are located in the isolation pools, the storage pools, the cutting pool, and the FDPA transfer channel to return water to the recirculating water treatment system. Sumps are located adjacent to the pools. The adjustable weirs direct the basin water flow to the sumps. The return lines from the isolation and storage pool sumps and the FDPA transfer channel sump discharge into a common return header back to a common return sump. Return lines are fed by gravity except the FDPA transfer channel sump, which is pumped to the common return header. The return sump contains three

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Figure 2-31. Normal flow pattern in fuel storage pools.

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Figure 2-32. Location of piping and piping trench in relation to Unloading Pool 1.

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pumps, P-FT-211 and -212, rated at 550 gpm, and P-FT-213 (inactive), rated at 275 gpm. The return sump pumps and the flow control system provide the required pressure and flow to circulate the water through the recirculating water treatment system described in Section 2.5.4.2 and distribute the water to the pools.

Isolation gates provide a means of individually isolating the unloading, isolation, storage, and cutting pools. The isolation gates have been described in Section 2.5.2.7. The FDPA transfer channel is equipped with a cover over the channel in the FDPA cell, but does not have an isolation gate. A portable submersible pump can be used to remove the water from an isolated pool or the transfer channel.

The basin water management system also includes a vacuum cleaning system for removing material from the pool walls and floors.

2.5.4.4 Basin Liner Leak Detection. The basin liner leak detection system consists of shallow water collection channels, underneath and around the pool area (referred to as leak chases), 11 sumps (of the type shown in Figure 2-33), and level instrumentation on the sumps. This system is designed to detect leaks that occur in the basin liner. The storage pools, the unloading pools (and the associated isolation pools), and the cutting pool each have sumps, and the transfer channel has 2 sumps. When water collected in a sump reaches the high-level alarm point, an alarm condition is indicated on the FDCS.

The 3/16-in.-thick stainless-steel basin liner plate covers the concrete floor and walls, which have built-in interconnecting leak chases to direct leakage toward the sumps mentioned above. Each sump is an 8-in.-diameter pipe that extends from the top of the pool to a point 2 ft below the bottom of the pool. The sumps are located so that leakage drains to them by gravity. Water collected in the sumps is pumped by a submersible pump to a container (carboy) for transfer to the basin DW neutralizer waste tank. Pumps are designed to prevent siphoning into the sumps. A similar leak detection system exists for the basin water return sump.

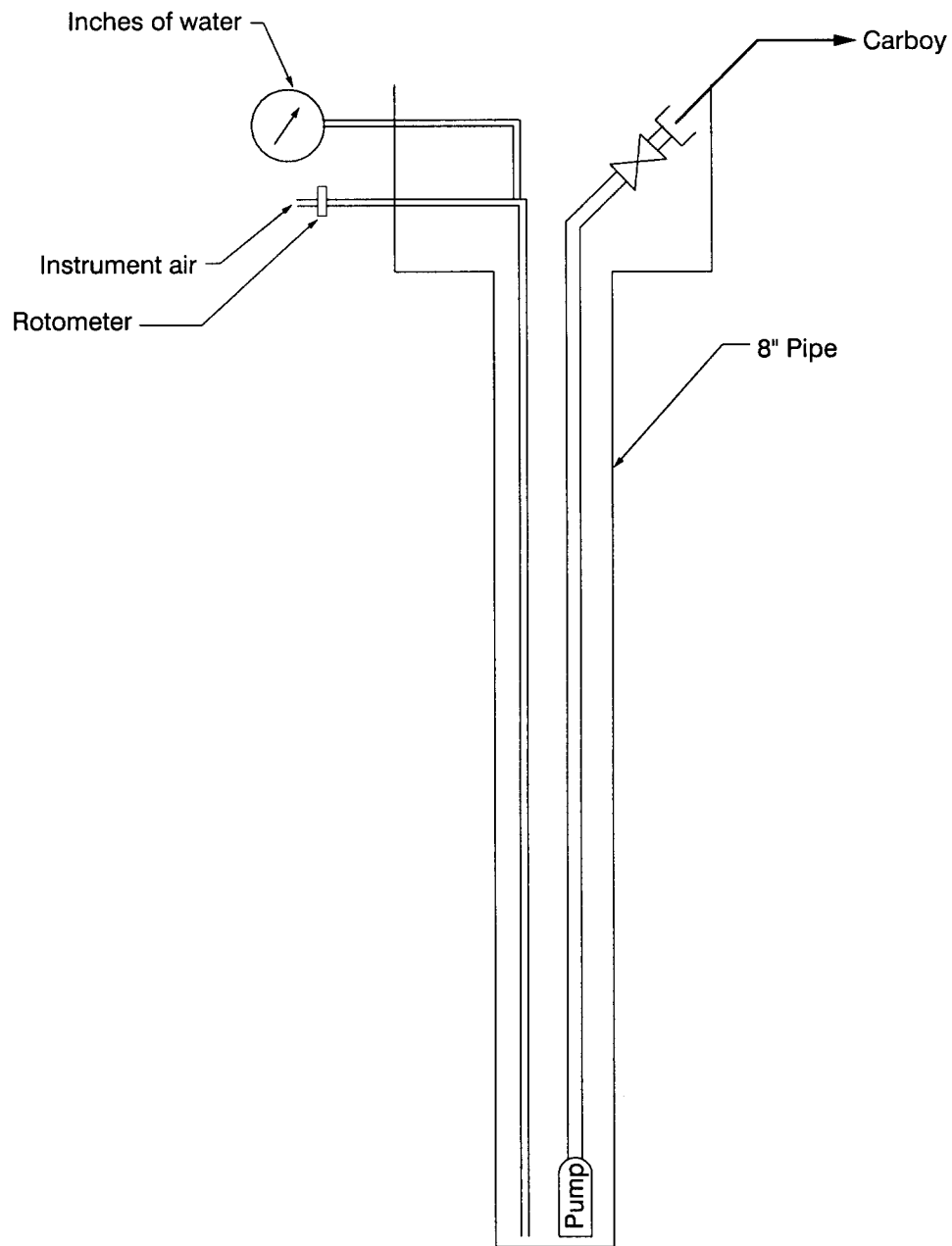
Water leakage from the pools does occur as a result of weld defects in the liner. The rate of leakage is inversely proportional to temperature. At lower temperatures, the liner shrinks, opening up the defects. Levels of the pool water and the collection system, and the sumps, were designed to reach steady-state. Due to the fact that there are potential leak paths between various portions of the facility structure via concrete pour defects, water can eventually flow to other locations, such as the FDPA.

2.5.5 Main Control Room (Shift Operating Base)

The main control room is now used as the FSA shift operating base. This room is the primary location for monitoring utilities (steam, water, and air) and remote area monitors (RAMs). In addition, remote monitoring and control of some ventilation, fuel handling and storage, and waste treatment parameters are available. The FDCS monitors and records some ventilation and utility system parameters and can be used to control water treatment equipment.

2.5.6 Heating, Ventilating, and Air Conditioning (HVAC)

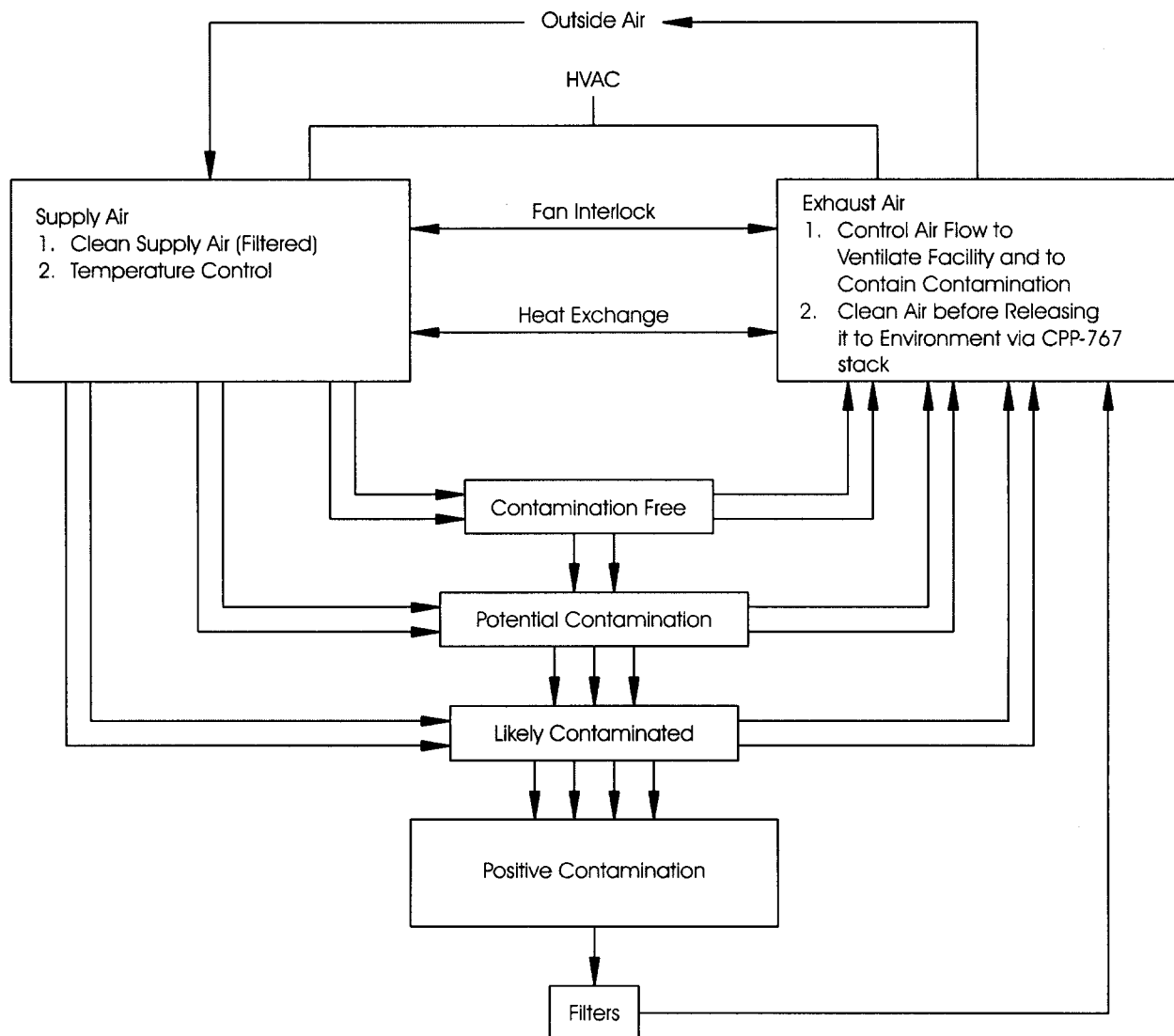
A general overview of the FSA HVAC system is shown in Figure 2-34, and a more detailed diagram can be seen in Figure 2-35. Ventilation air that enters the FSA, except for the small amount introduced through personnel and vehicle entries, is filtered at a common inlet and distributed throughout the building. Ventilation air is once-through and is directed from contamination-free areas to potentially contaminated areas to likely contaminated areas. The ventilation system maintains the building at a slightly negative pressure, and ventilation air is discharged through a final filtration system. The design air supply to the building is approximately 84,600 ft³/min. Normal infiltration plus compressed gas usage adds approximately 6,100 ft³/min, resulting in a total of approximately 90,700 ft³/min of gas processed through the final HEPA filter system for release through the 50-m (164-ft) stack (CPP-767).

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NOTE: Water enters sump from leak chases
in concrete basin floor.

Figure 2-33. Basin liner leak detection sump.

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Figure 2-34. General overview of FAST ventilation and exhaust system.

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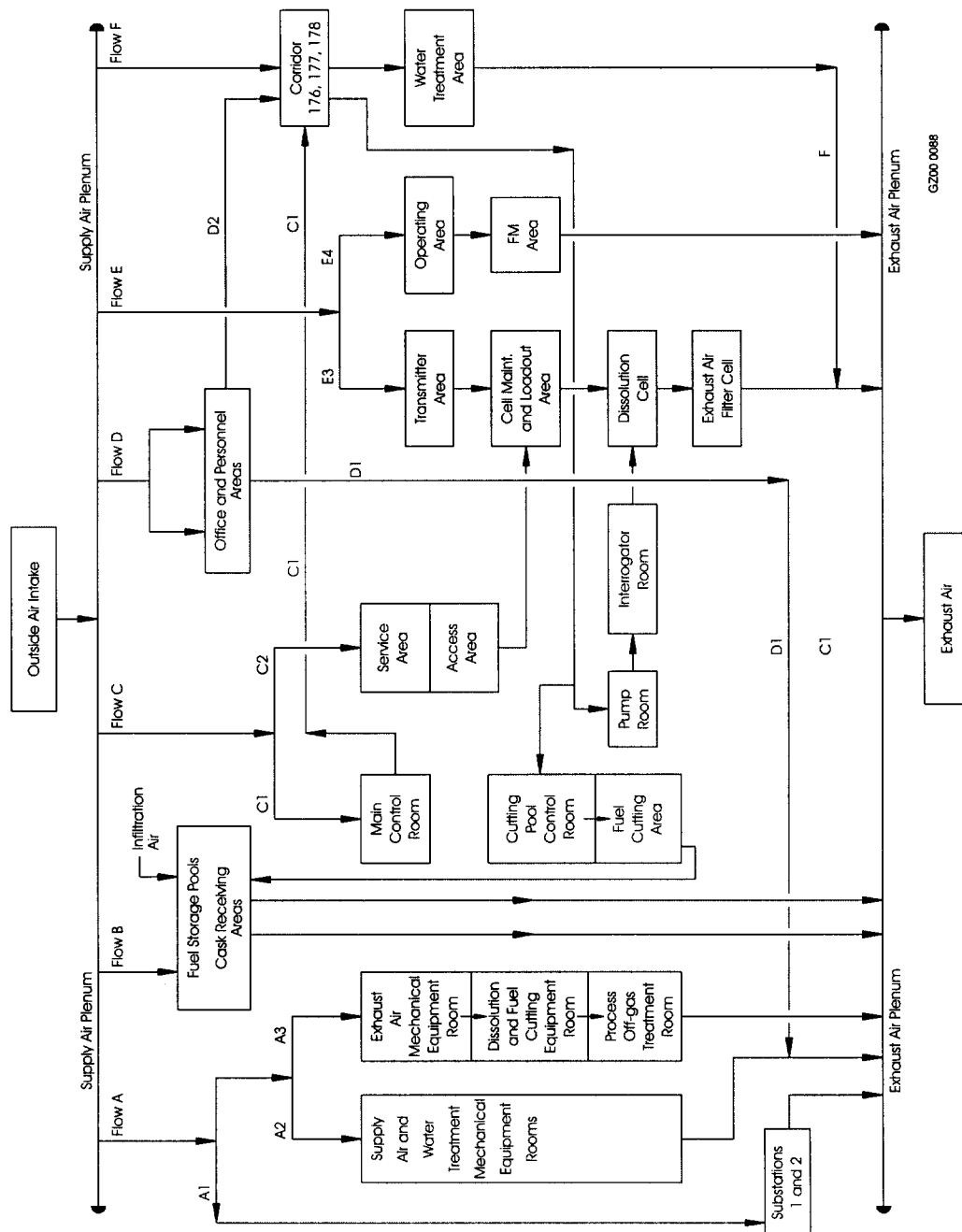


Figure 2-35. Flow diagram of FAST HVAC ventilation.

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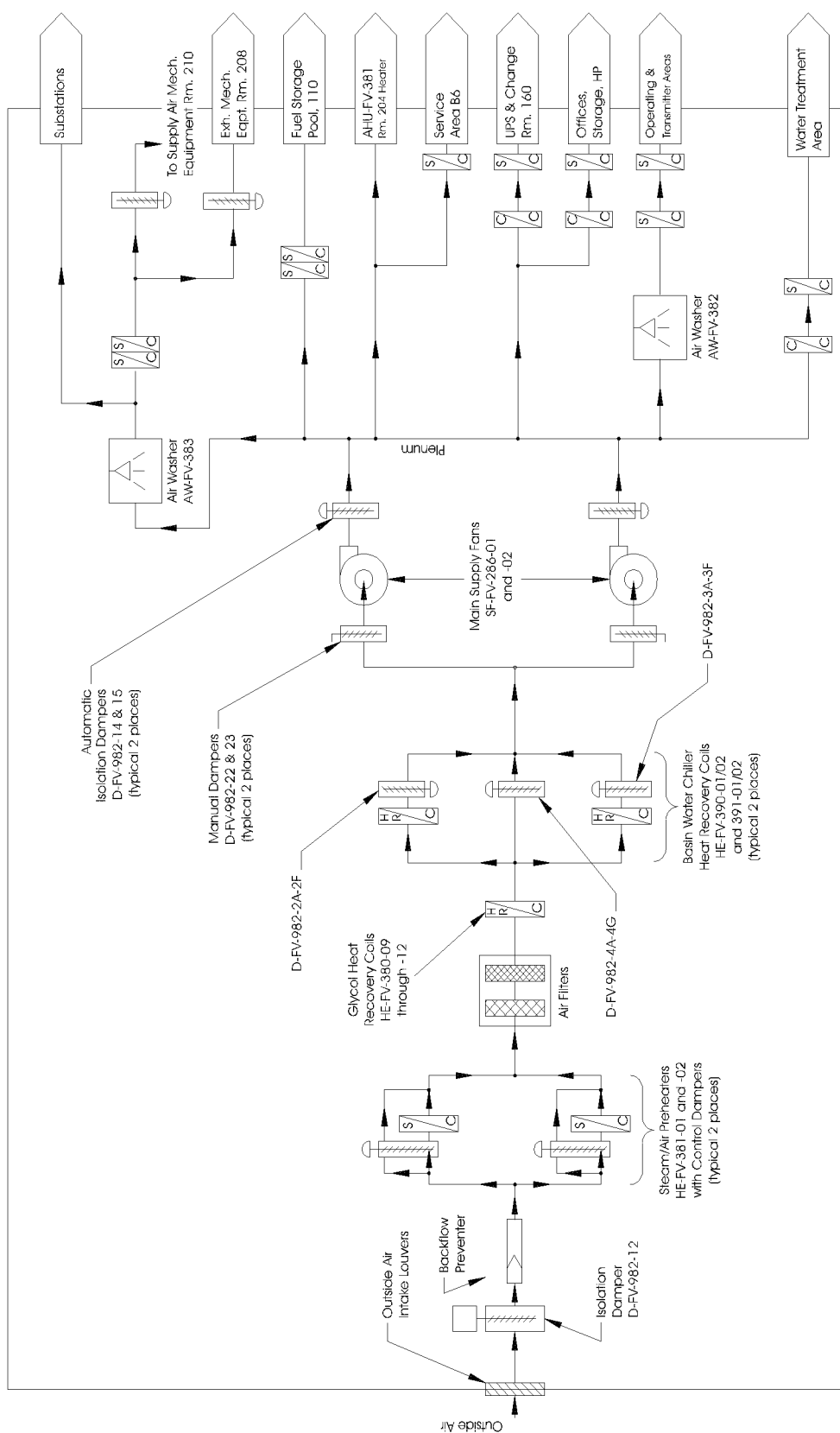
The supply air system is shown in Figure 2-36. Air enters the ventilation supply system through louvers. A set of roughing filters precedes two parallel fans, each capable of providing half the design air supply. The supply fans are equipped with variable pitch inlet vanes that automatically maintain the supply air pressure. A backflow damper downstream of each fan is interlocked with the supply fans and closes when the fan is de-energized. The air supply system also includes the heating system (steam and two heat recovery systems) and evaporative cooling-air washing units. These air washers are an in-line system and air passes through them. The water supply to these systems has been isolated.

An interlock ensures that the inlet supply fans do not operate if the supply inlet damper closes or if one of the two operating final exhaust fans shuts down. The supply fans also cease operating on loss of normal power. In order for the supply fans to be started, the following three conditions must be met: (1) the supply damper must be open, (2) two of the three final exhaust fans must be operating, and (3) normal power must be available.

The exhaust system design includes two or three parallel trains of prefilters, HEPA filters, and fans to exhaust FDPA dissolver process off-gas, the FDPA dissolution cell, the fuel cutting pool area, and the water treatment area prior to mixing the exhaust with the building ventilation air in the common duct to the final HEPA filter system. The FDPA dissolver process off-gas system is isolated since the FDPA is inactive. The fuel cutting pool area exhaust filters are also isolated. The fuel cutting pool area is exhausted via a pipe trench that connects the cutting pool area to the fuel storage pool area. Air leaving the facility is directed to a common duct for routing through the final HEPA filter system before release to the atmosphere, as shown in Figure 2-37. Exhaust air passes through an in-line fire protection chamber (currently inactive) and divides into four parallel filter banks. Each bank is designed to handle 25% of the total airflow and consists of medium-efficiency prefilters, followed by HEPA filters. The system is equipped with instrumentation to measure the pressure drop across the filters. A water spray deluge system exists but has been made permanently inactive because the FDPA has been shut down and the threat of a hydrogen fire no longer exists. Manually operated, positive-shutoff dampers can isolate each filter bank from the exhaust airflow. Following the filters and a heat recovery coil in each duct, the air passes through a common duct to the exhaust fans.

Three exhaust fans, each sized for half the total flow (45,350 scfm), exhaust the air from the building through an underground tunnel to the exhaust stack. Each fan has variable-pitch inlet vanes automatically controlled by pressure sensors upstream of the final filters. Each fan is isolated by pneumatically operated dampers that close automatically when the fan is not operating. An exhaust relief system vents air to the atmosphere ahead of the exhaust tunnel in the event of excessive discharge pressure. The rooftop vent is located in the northwest corner of the FAST support area.

The fan motors, variable-pitch fan intake vanes, isolation dampers, and stack bypass relief are automatically activated and interlocked. Alarms sound if pressure differentials exceed either high or low settings or if airflow drops below the operating limit setting. The final exhaust fans also shut down if there is low flow, and they cannot restart until they are manually reset. Power to the exhaust fan motors is supplied from the standby motor control centers (SMCC). During the period between loss of normal power and load pick up by standby power, the exhaust fans cease operating and the isolation dampers close. Exhaust fans restart when power becomes available. If one of the two operating fans fails to start or fails after starting, the standby fan starts automatically.



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Figure 2-36. FAST HVAC supply airflow.

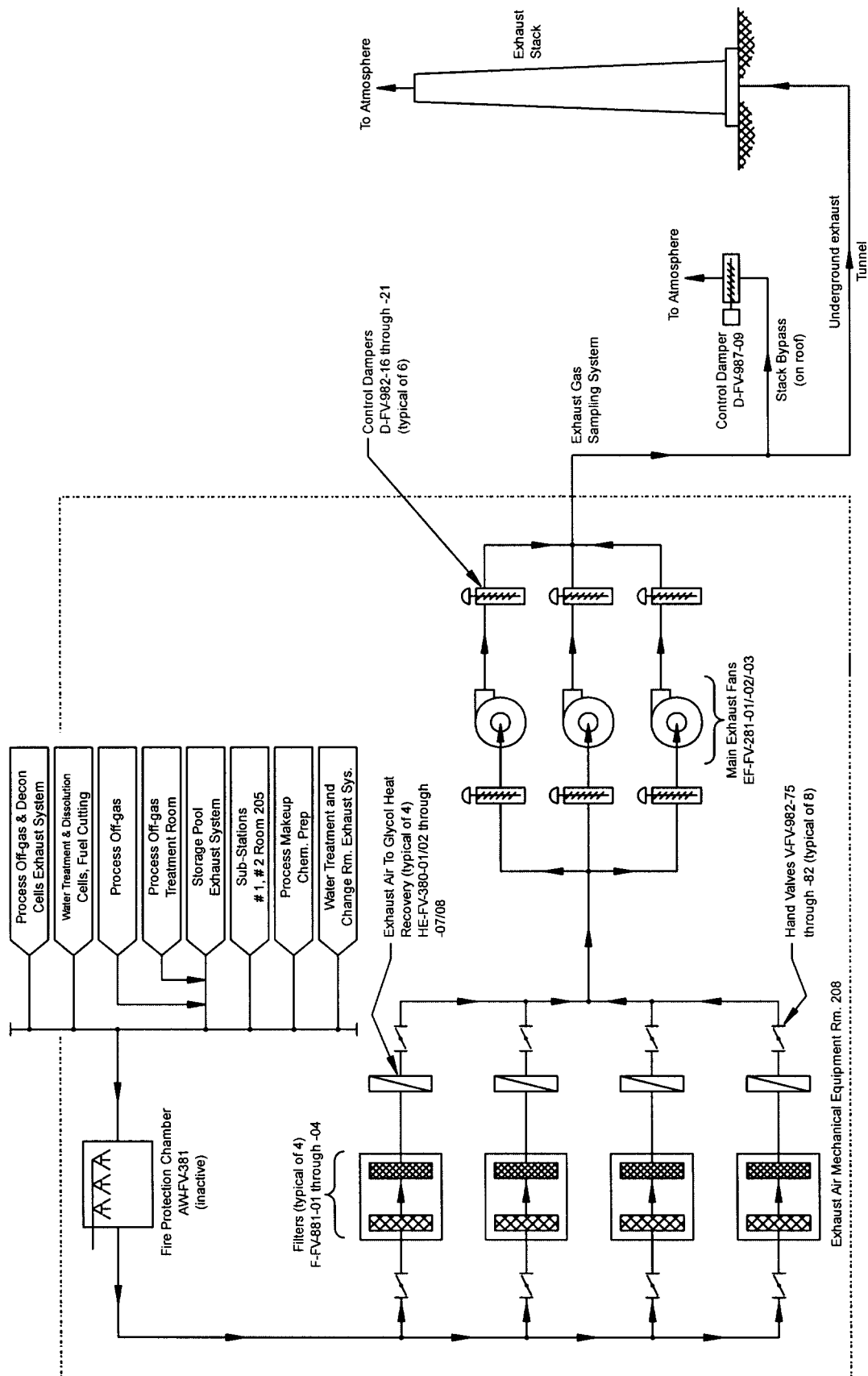
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Figure 2-37. FAST HVAC final exhaust airflow.

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Two heat recovery systems are installed at FAST to reclaim the exhaust air waste heat and the decay heat from the stored fuel. The propylene glycol heat recovery system transfers heat from the exhaust air to the supply air via the circulation of an aqueous solution of propylene glycol through the heat recovery system. The basin water chiller heat recovery system, although inactive, interfaces with the basin water chiller serving the basin treatment system and was designed to transfer heat recovered by the chiller to the ventilation supply air.

The FAST heating and ventilation system is designed to withstand the operating basis earthquake (OBE) or, in the case of FDPA cell ventilation, the DBE, without loss of capability for performing its function. The stack is designed in accordance with UBC recommendations for Seismic Zone 3.

Airflow is maintained in the specified direction by appropriate ducting of supply and exhaust air to and from each area and by controlling the area pressure. The pressure is maintained by varying the supply air to an area and keeping the exhaust flow constant. Area pressures are referenced to the basin area because of the large volume of stable air present in that area.

Pressure differential and flow control instruments at principal supply and exhaust points within the system send alarm signals to the main control room and local control panels if set limits are exceeded. Pressure and flow measurements are indicated at the main control room as well as locally within the system, and key functions of the air supply and exhaust system are controllable from the main control room.

Ventilation exhaust filters are designed for ease of changeout and for bagout of the used filters to control contamination. The HEPA filters have a minimum efficiency of 99.97% for 0.3- μ particles. In-place filter leak-testing provisions are incorporated in the design. Radiation monitors detect changes in radioactivity buildup on filters and alarm when set points are exceeded. Local readout instrumentation for pressure drop across the filters indicates changes in filter dust loadings. A stack monitoring system is in place to sample a known representative fraction of the air leaving the facility.

During abnormal or accident conditions, negative pressure within the building as well as directed airflow through ventilation filters can be maintained at less than 50% of design flow rates with supply dampers closed and only one exhaust fan operating. Throttling of dampers in selected areas can further reduce the airflow requirements during abnormal or accident conditions. Building ventilation parameters can also be adjusted, or the system can be shut off, as needed, to support operations, maintenance, or other considerations. This flexibility is possible since system operation is not required for safety purposes, as shown by the hazard evaluation in Chapter 3.

2.6 Confinement Systems

At the FSA, two or more barriers are generally present to limit potential releases of radioactive material. The FSA includes the following design features or systems for confinement of radioactive materials:

- *Fuel cladding and/or fuel can* — The design philosophy for the FSA was that the fuel cladding would provide the principal confinement barrier to the release of fission products and that the facility design would preclude a massive failure of the cladding of the fuel stored in the pools. Fuels with cladding defects sufficient to produce undesirable pool conditions may be canned to provide an equivalent level of protection, as described in Section 2.5.2.5.

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- *Shipping casks* — The fuel shipping casks are designed to provide shielding and, in some cases, containment or confinement of gases, liquids, or solids. Casks approved for use at the FSA are listed in Chapter 6.
- *Basin water* — The water in the FSA (unloading pools, isolation pools, transfer channel, storage pools, and cutting pool) provides radiation shielding for normal fuel handling operations. For postulated accident conditions, the water also reduces radioactive material releases (via water-to-air release fractions).
- *Building ventilation system* — Building ventilation is designed to maintain pressure within the FSA below atmospheric pressure to ensure that building exhaust is directed through the final HEPA filtration system. Pressures are progressively lower from clean areas such as offices to potentially contaminated and likely contaminated areas to direct airflow accordingly. Backflow dampers prevent air from flowing in unintended directions. The backflow dampers also prevent release of unfiltered air during a transient pressure imbalance between the building and the environment. Supply air HEPA filters in the water treatment area and the FDPA also ensure that air that could conceivably flow backward through the inlet ducts will be filtered prior to release into clean areas. Barriers, airlocks, and seals are used to control undesirable airflow paths between areas via passageways and wall penetrations. Process and facility confinement barriers are reinforced by systems that detect leakage and provide alarms (RAMs and CAMs) if airborne contamination is detected. Additional details concerning the HVAC system are available in Section 2.5.6.
- *FAST building* — The physical structure of CPP-666 provides the final confinement barrier between the FSA and the environment. The FAST building is designed to withstand a DBT and a DBE and to maintain its integrity during postulated design basis events for the FSA, as described in Section 2.4.2.

2.7 Safety Support Systems

No FSA safety support systems have been identified.

2.8 Electrical Utility Distribution Systems

This section describes the electrical power system for FAST, including normal power, standby power, and uninterruptible power. A generalization of the main electrical system is shown in Figure 2-38.

2.8.1 Normal Power

Normal (commercial) electric power is supplied to CPP-666 from the INTEC electrical distribution system to two power control centers (PCCs), PCC-FT-411, and PCC-FP-413 in CPP-666. These PCCs receive power at 13,800 V, and PCC-FT-411 and PCC-FP-413 transform it to 480/277 V. The two 1,500-kVA PCCs (PCC-FT-411 and PCC-FP-413) share the normal electrical power load for the rest of CPP-666 requirements. They feed motor control centers (MCCs) located near their loads.

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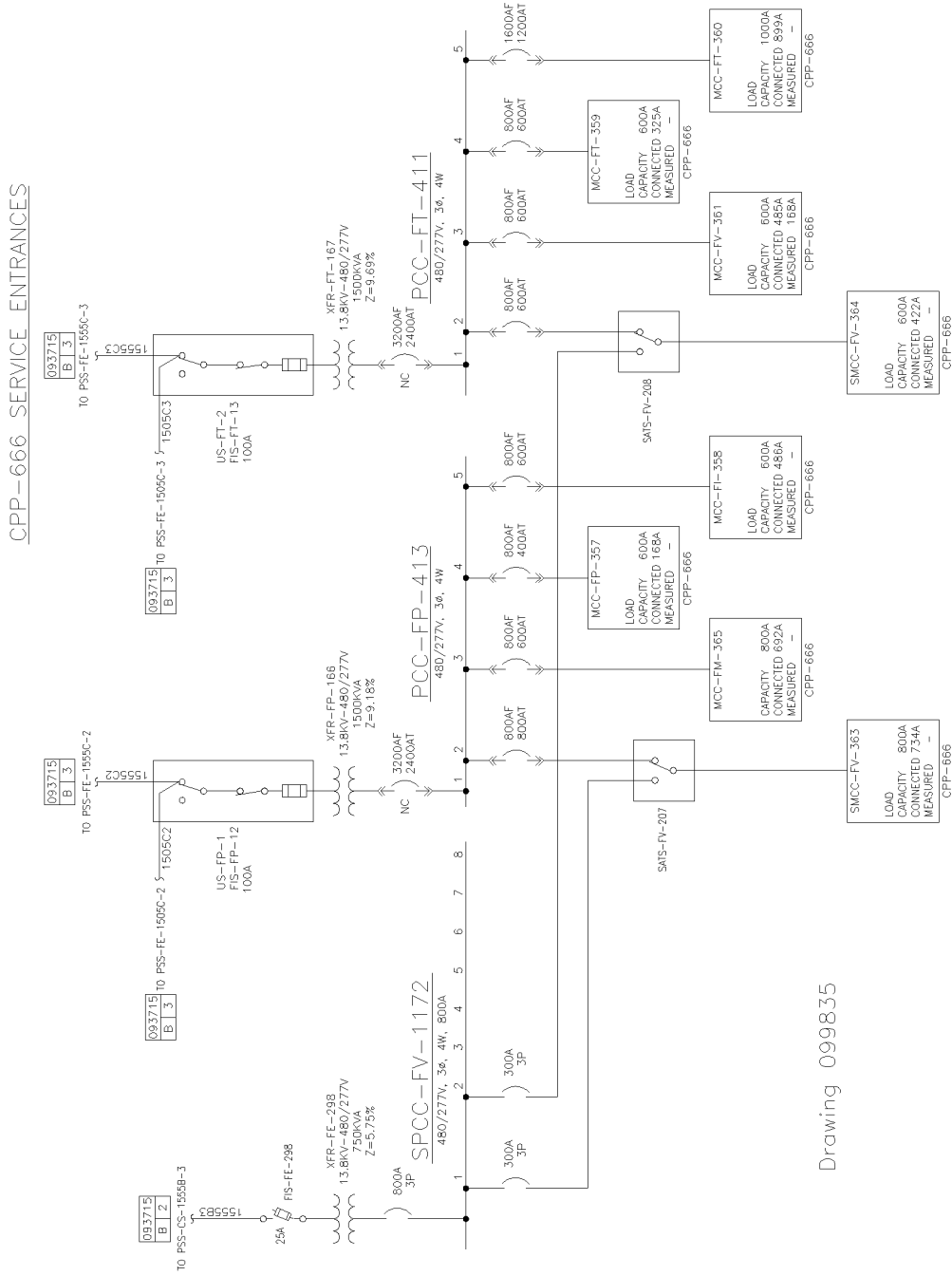


Figure 2-38. FSA electrical power system diagram.

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Each PCC includes a silicone liquid-filled transformer, a high-voltage primary interrupter switch and fuse, and reduced-voltage switchgear. The PCCs are located in CPP-666 near the centers of the powerloads. PCC-FT-411 is located in a room just north of the water treatment area (Room 163). PCC-FP-413 is located in a room at the north end of the building (Room 125).

The PCCs were manufactured to National Electrical Manufacturers Association standards. Switchgear is listed in accordance with Underwriters Laboratories standards. PCC rooms have outside access for maintenance convenience and for positive isolation from radioactive contamination. Ventilation for the PCC rooms is designed to keep ambient temperatures below 35°C (95°F). The building structure for PCC rooms and equipment installations is designed to withstand the OBE without loss of function. Curbs are provided around substations for containment of transformer oil spills.

2.8.2 Standby Power

PCC-FT-411 and PCC-FP-413 each provide power to a standby motor control center (SMCC) during normal operation. If power is lost only to CPP-666, but is still available for the rest of the INTEC area, a switch to the available power occurs. If power is lost to the total INTEC area, the generators located at INTEC automatically start to supply power to the standby power system through SPCC-FV-1172. The following FSA equipment is typical of that supplied by standby power:

- Cask handling, fuel handling, and cutting pool cranes
- Water treatment, dissolution cell and fuel cutting, and final exhaust fans
- Remote area monitors (RAMs) and continuous air monitors (CAMs) at some locations
- Local control panels and main control room panels necessary to operate standby powered equipment
- Stack radiation monitor
- Exit and emergency egress lighting.

2.8.3 Uninterruptible Power

Uninterruptible power is provided from multiple, small uninterruptible power sources connected to selected FSA loads. The 30-kW uninterruptible power system (UPS) required when the FDPA was operational is bypassed via the maintenance bypass, and the batteries have been removed. The former UPS for the Plant Protection System (PPS) is inactive.

The fire protection and alarm panels, the emergency communication system, and the emergency egress and exit lights have continuous, uninterruptible power and have separate local, dedicated battery backup system.

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2.9 Auxiliary Systems and Support Facilities

Descriptions of the auxiliary systems and support facilities for the FSA are presented in the following sections. These include water, steam, sewer, plant and instrument air, breathing air, nitrogen, cold chemical systems, communications and alarms, and fire protection.

2.9.1 Water

Treated water, potable water, fire water, and DW are provided to CPP-666 from the INTEC water distribution systems. No raw water is used. Except for the DW, the water to CPP-666 is supplied from two different locations in the INTEC distribution systems. Therefore, reliability of the water supplies to CPP-666 is determined by that of the INTEC distribution systems.

Treated water could be used for flushing process lines that transfer liquid waste from CPP-666 to the PEW system.

Potable water is supplied from a dedicated well to utility sinks, electric water heaters, safety shower/eyewash stations, electric water coolers, and the change room plumbing fixtures.

DW is provided to replace water in the storage pools lost by evaporation and to supply other uses, such as decontamination (see Section 2.5.4.1) or cask filling.

Basin water makeup and other requirements can be deferred almost indefinitely without causing significant problems. Since the propylene glycol cooling system is air-cooled, the pool water temperature can be held stable during a loss of water supply as long as the recirculation system is operated. This, and the large volume of water in the pool water, allows the pool water to be safely operated without the use of makeup water services for long periods of time in an emergency situation. If it should become necessary to replenish basin water with lower-quality water, the quality can be re-established later by operation of the recirculating water ion-exchange units.

2.9.2 Steam

Steam is supplied at 100 to 135 psig to CPP-666 from the steam generating and distribution facilities. At the FSA, the primary uses of steam are space heating and maintenance. Steam could be used for decontamination. Condensate from header traps and space heaters is returned to the steam condensate collection system for reuse, but can also be diverted to service waste. Prolonged outages of steam service may result in personnel discomfort and freezing of some fire water lines during extreme winter weather. In extremely cold weather, portable electric or petroleum-fired heaters can be used to heat piping. Building ventilation can safely be reduced or shut off completely during prolonged shutdown of the steam supply to limit incoming cold air.

2.9.3 Sewer

The sanitary sewer system is a network of piping designed to drain the waste output from the potable water supply fixtures in the change room areas, the office area floor drains, and the water coolers in the office area. These wastes are drained via a single sanitary waste header to the existing INTEC sanitary waste collection system located at the north end of CPP-666.

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Compressed dry air is supplied to CPP-666 from the INTEC compressed air distribution. CPP-666 plant air is received at 100 to 115 psig through two lines from the INTEC compressed air distribution system (north and west utility interfaces). In CPP-666, individual pressure reducers are used to supply the pressures for branch line or equipment requirements. Compressed air is distributed throughout the operating and maintenance areas to air supply stations. These stations provide air for control valves, control mechanisms, and similar items in the HVAC and water treatment areas. Instrument air is filtered and reduced to 20 psig at the point of distribution.

2.9.5 Breathing Air

Breathing air for use in fresh air respirators, masks, and “bubble suits” is provided by portable trailers as needed. In addition, the breathing air compressors located in the CPP-666 water treatment area are capable of supplying air to CPP-666. Breathing air could be distributed at approximately 85 psig to breathing air outlet stations located throughout CPP-666.

2.9.6 Nitrogen

A nitrogen generator (GEN-FL-913) supplies nitrogen to selected shielding windows and instrument probes in the FDPA. It also supplies nitrogen to the two shielding windows in the waste load-out cell at the FSA water treatment area and provides a blanket of nitrogen to Waste Tanks VES-FT-141 and -142. This generator is installed in the northwest corner of the –13-ft level of CPP-666 on the FDPA side. The generator produces between 100 and 500 scfh of 90 to 99% clean dry nitrogen. In addition, nitrogen bottles may be used to supply backup gas to the final exhaust fan isolation dampers (stack bypass dampers) in the event an instrument air failure occurs, thus assuring that the dampers remain open.

2.9.7 Cold Chemical Systems

The cold chemical systems were designed to supply nonradioactive reagents and decontamination solutions in support of CPP-666 activities. The chemical solutions for this system were to be provided by the decontamination makeup system located in the water treatment area. Equipment, consisting of three makeup vessels, a vent scrubber, three low-pressure pumps, one high-pressure pump, and a distribution system, was installed. The decontamination distribution system was originally installed to provide solutions to the following areas:

- Cask decon rooms (see Section 2.5.1.4)
- Cask receiving area, fuel storage pool area, water treatment area, and HVAC filter changeout area for directly controlled spray, flush, and wipedown decontamination capability
- The truck receiving area for washing down casks and vehicles to remove road dirt and oil prior to entering the cask receiving area
- Both fuel unloading pools for washing down casks as they are lifted from the water.

The system was designed with connections for hoses in the waste loadout cell that could be held by manipulators to direct chemical decontamination solutions on specific pieces of equipment. Water, nitric acid, decontamination solutions, purge air, or steam were originally intended for use with these hose

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stations. The system has been modified to feed 0.5M nitric acid to the basin water filters. This piping modification provides a method to chemically clean the stainless-steel disks and remove the biofilm from them.

With the inactivation of the FDPA and disposal versus regeneration of basin water treatment resins, there are no requirements for, or storage of, significant quantities of chemicals at the FSA. Only water, rather than chemicals, is now used for decontamination. Consequently, the only chemicals used at the FSA on a routine basis are nitric acid and small quantities of commercial chemicals such as janitorial supplies. Nitric acid is used in small quantities approximately twice annually. When needed, it is brought by bottles or carboys into the FSA in quantities of approximately 5 gal or less. The tanks, pumps, equipment, and lines associated with the cold chemical systems are inactive, and the chemicals have been removed.

2.9.8 Communications and Alarms

Communications within the FSA facility are provided by a voice communication system and emergency alarms, as described in the following sections.

2.9.8.1 Voice Communications. A voice communications system is provided within the FSA. This system provides both normal telephone service and telephone paging. Speakers, telephones, and telephone jack receptacles are located throughout the interior of the FSA.

2.9.8.2 Emergency Alarms. Emergency alarms at the FSA are provided by the INTEC Emergency Communication System. These alarms include evacuation; take cover; and fire alarms, signals, and announcements. CPP-666 evacuation can be activated manually from a panel at the main control room (shift operating base) or from two other local boxes in CPP-666, one outside the decon rooms and one in the south end of the cask receiving area. If required, an INTEC-wide evacuation can be initiated by a separate switch at the main control room. The speakers for the Emergency Communication System are strategically located throughout CPP-666 to provide complete coverage for normally occupied areas. The location of emergency equipment in the FSA is shown in the INEEL Emergency Plan/RCRA Contingency Plan (PLN-114).³⁸

2.9.9 Fire Protection

The CPP-666 fire protection system is designed to meet the standards of DOE Order 420.1A.¹⁵ No Halon or CO₂ fire suppression systems are in use at the FSA.

The basic fire suppression system for the FSA consists of sprinklers augmented by hand-operated extinguishers and fire department connection stations. Both wet- and dry-pipe sprinkler systems are used to cover the FSA, except for the pool area. Because of the possibility of freezing temperatures, a dry-pipe system is installed in the truck receiving area. This dry system enters through a 6-in. riser on the west side of the building. Both the wet and dry systems are included in a preventive maintenance program.

Fire water for CPP-666 is supplied by the fire protection water distribution system. The INTEC General Area Fire Protection Fire Hazards Analysis provides details concerning the INTEC fire water supply systems.

The FSA design minimizes combustible material and chemical storage within the facility. The bulk of the combustible materials in the FSA is paper and plastic packaging materials, and office and clothing

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supplies. The only chemicals used at the FSA are small quantities of nitric acid, janitorial cleaning supplies, etc. (see Section 2.9.7).

An evaluation of the potential for a fire in each of the major areas of the FSA is summarized in Table 2-8. A fire hazard analysis of the FSA³⁹ has also been performed in accordance with the requirements of DOE Order 420.1A.

The fire detection and alarm system for CPP-666 is an extension of the INTEC system. If an alarm actuates, a signal is transmitted to the INEEL alarm center, indicating that a fire system alarm has been initiated at CPP-666. The INTEC Emergency Communication System is also activated for fire annunciation. Power for operation of the fire detection system is backed up by dedicated batteries.

Fire extinguishers are located throughout the FSA as necessary. The main control room, the adjacent office, substations, and the UPS battery room are isolated from the remainder of the facility by 2-hr fire-rated doors and walls. (The original lead-acid batteries have been removed.)

The FSA fire detection and alarm system complies with National Fire Protection Association (NFPA) Standard 72,⁴⁰ and the sprinkler systems comply with NFPA Standard 13.⁴¹ Provisions also are made for isolating and storing chemicals in accordance with the recommendations of NFPA Standard 49.⁴² The underground firewater distribution for CPP-666 complies with NFPA Standard 24.⁴³

Electrical and control wiring is routed through concrete-encased duct banks, metallic conduit, and metal trays. Wire sizes and routings meet the requirements of the National Electrical Code. Electrical penetrations are sealed to give fire protection equivalent to that of the penetrated barrier.

Wiring insulation in the facility is waterproof and resistant to degradation for temperatures up to 200°F. Conduit is used where there is a possibility of damage or degradation due to either normal or abnormal conditions.

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Table 2-8. Evaluation of potential for major fire in the FSA.

Location	Potential for Fire in Area	Fire Protection Design Provisions
<u>Fuel Storage Area</u>		
Truck receiving area	Potential for fire involving diesel fuel, motor oil, and rubber.	A dry-pipe sprinkler system and portable fire extinguishers. Sprinkler system design is Ordinary Hazard Group II, per NFPA 13.
Cask receiving and decontamination area	Characteristics of fire similar to truck receiving area. Some welding may be conducted in this area.	A wet-pipe sprinkler system and portable extinguisher as above are provided. Sprinkler system design is Ordinary Hazard Group II, per NFPA 13.
Storage, unloading, isolation, cutting pools, and transfer channels	Only combustibles are parts of crane. Fires likely to be electrical.	Area over pools is not equipped with sprinklers, but fire extinguishers are located throughout the FSA as necessary.
<u>Water Treatment Area</u>		
Shielded equipment cells: DW neutralizer waste tank vault, spent resin waste tank vault, waste loadout cell, anion/cation vaults, BW filter cells, and blower room	Little combustible material.	None.
Shielded pipe areas: pump corridor, shielded pipe chases, and shielded pipe areas	Little combustible material. Some instrumentation in the areas.	Pump corridor is protected by a wet-pipe sprinkler system. Sprinkler system design is Ordinary Hazard Group I, per NFPA 13.
Cold support areas: decon pump mezzanine, decon makeup area, corridor, resin loading room, regeneration chemical area, chiller room, chiller H&V area, cask loadout and transfer area, sump room, operating area, cask cool down area, liner leakage tank room, valve room, and extra room at elevation –13 ft 0 in.	Chemicals, wiping rags, contaminated anticontamination clothing in bags, and resin under water are stored in these areas. Decontamination reagents vary, but some could be organic. Electric motors, MCCs, and some switchgear are also in these areas.	Areas are protected by a wet-pipe sprinkler system. Sprinkler system design is Ordinary Hazard Group I, per NFPA 13.

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Table 2-8. (continued).

Location	Potential for Fire in Area	Fire Protection Design Provisions
<u>Main Control Room (Shift Operating Base)</u>	Computer, control consoles, written logs.	The main control room is protected by a wet-pipe sprinkler system above and below the suspended ceiling. System design is Ordinary Hazard Group I, per NFPA 13.
<u>Fuel Storage Support Area</u>		
Offices (including the cutting pool control room), change rooms, HP and first aid rooms	Office furniture and files, personal clothing in offices, and closed locker areas; possible contaminated clothing in restricted plant clean locker.	Sprinkler protected. System design is Ordinary Hazard Group I, per NFPA 13.
Unit Substations 1, 2, and 3	Substations contain electric switchgear and oil-filled transformers.	Units have smoke detection instruments. System design is Ordinary Hazard Group I, per NFPA 13. ^a
UPS room	UPS room contains switchgear.	Sprinkler protected. System design is Ordinary Hazard Group I, per NFPA 13.
Supply air mechanical equipment room, process off-gas room, dissolution cell and fuel cutting exhaust mechanical room, and exhaust air mechanical room	Little combustible material in off-gas and ventilation mechanical equipment rooms. Filters contained in metal housings. Some electric motors, MCC, and wiring.	Sprinkler protected. System design is Ordinary Hazard Group I, per NFPA 13.
Filter storage	Filter stored in room.	Sprinkler protected. System design is Ordinary Hazard Group I, per NFPA 13.

a. The substations are not protected by fire suppression systems; rather, protection is provided by emergency response in the event of a fire.

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